SCIENCE ABSTRACTS.

Section A.—PHYSICS.

JULY 1907.

GENERAL PHYSICS.

1118. *A Helio-chronometer.* (Engineering, 83. p. 657, May 17, 1907.)—This instrument, the invention of G. J. Gibbs, is an improvement of the sun-dial. It is constructed entirely of gun-metal, and consists of three chief parts—a universal stand, an hour circle, and a year circle. The stand is a ball-and-socket device, which enables the necessary adjustments for latitude and level. The hour circle can slide round on the upper part of the stand so as to cause the sun to shine through a small hole in the upper of two screens, and cast a spot of light on to a centre line scribed on a lower screen, thus indicating Greenwich time. The year circle has the months engraved on it, and a cam is formed on its under side of such a shape that when the year circle is turned to indicate the current month and day, the cam automatically applies the necessary corrections for the equation of time. Illustrations explain the cam connections and the instrument as a whole. A few seconds being sufficient to show the movement of the spot of light on the screen, the helio-chronometer is considered as furnishing a standard of reference for correcting clocks and watches in places where Observatory time is not available. G. E. A.

1119. *Numerical Expression of the Hardness of Solids.* **W. Lermantov.** (Jurn. Russk. Fisik.-Chimičesk. Obščestva, 38. No. 2. Physical Part, pp. 82–84, 1906.)—In experimenting on a new method of hardening steel which the author discovered in 1896 in the course of a search for a test experiment for the modern theory of hardening, he obtained a specimen partly hardened which was able to scratch the same steel unhardened, although it had a noticeably lower absolute hardness. The hardness was measured by Brinell's method, a ball of 1 cm. diam. giving an impression of diam. 2·967 mm. for the hardened piece, and of 2·689 mm. for the same bar unhardened. This experiment shows that the sclerometric hardness and the "absolute hardness" (Hertz-Auerbach) measure very different properties of the material. In order to obtain such a hardness (corresponding to a sorbitic structure of the steel), it is necessary to work only just below the critical temperature. If the heating is carried 5 to 10° C. higher, the absolute hardness increases suddenly without any noticeable rise in the sclerometric hardness. By adjusting the temperature very accurately an edge can be obtained which will scratch glass and which can be worked down considerably under the hammer before cracks make their appearance. L. H. W.

1120. *Stresses due to Temperature Gradient in Hollow Cylinders.* **R. Lorenz.** (Zeitschr. Vereines Deutsch. Ing. 51. pp. 743–747, May 11, 1907.)—Gives a mathematical solution, with tables of the values of the constants for given conditions. It is shown that independently of the actual law of temperature distribution, the tangential and axial stresses at a point are equal, and the difference between the greatest stresses is proportional to the difference between the temperatures of the outer and inner surfaces (T_1 and T_2). The stresses are only further dependent on the ratio (β) of the outer and inner radii, and the properties of the material. The complete formulæ for the stresses s_1 and s_2 are—

$$s_1 = (m+1)/(m-1)\,\alpha C\,(T_1 - T_2)\,[2/(\beta^2 - 1) - 1/\log\beta],$$
$$s_2 = (m+1)/(m-1)\,\alpha C\,(T_1 - T_2)\,[2\beta^2/(\beta^2 - 1) - 1/\log\beta],$$

where m is Poisson's ratio, C the modulus of elasticity in shear, α the coefficient of expansion. Examples of the application of the formulæ are given. F. R.

1121. *Collapsing Pressures of Bessemer Steel Lap-welded Tubes.* **R. T. Stewart.** (Amer. Soc. Mech. Engin., Proc. 28. pp. 1440–1447, May, 1907.)—The formula $P_2 = 0{\cdot}0926\,(P_1 - 47{\cdot}55)/(M - 0{\cdot}874) + 47{\cdot}55$ represents closely the results of the author's tests on lap-welded Bessemer steel tubes 10 in. in diam., 0·15 to 0·20 in. thick, and 20 ft. long between end connections which tend to hold them to a circular form. P_1 is the collapsing pressure (lbs. per sq. in.) of normally round tube; P_2 is the collapsing pressure of a previously collapsed tube, the ratio of whose maximum to minimum outside diameters is M. It is shown that a tube of this class, if designed with an ample factor of safety—say 5 for ordinary conditions—would not fail in service through any departure from roundness which passes ordinary inspection (*i.e.*, about 0·2 in maximum). [See Abstract No. 3 (1907).] F. R.

1122. *Young's Modulus as a Function of the Elongation of a Wire.* **E. A. Kyrillov.** (Jurn. Russk. Fisik.-Chimičesk. Obščestva, 39. No. 3. Physical Part, pp. 64–80; Note by **B. P. Weinberg**, pp. 81–82, 1907.)—At the suggestion of Weinberg the author has made accurate measurements of the small elongations in a steel wire 16 m. long, produced by a constant surcharge ($\Delta P = 2$ kg.) of loading with different initial loads ($P = 14$–66 kg.). The elongations (2·22–2·24 mm.) were measured by an electrical method with an accuracy within 1/2000 mm. Although the wire was kept for a long time heavily loaded, the small surcharge produced gradual but very slow elongation —in the mean about 0·0002 mm. per min. All the measurements were reduced to the same duration (3 min.) of action of the surcharge and to the same temperature. To obtain from the elongations ΔL the value for Young's modulus, the author used the actual lengths L and sections S of the wire under load, and not the initial values (L_0 and S_0). Then, to calculate S_0 from S, Poisson's ratio σ was determined for the same wire. The results are set forth in two tables. Weinberg in his Note compares these results with those of J. O. Thompson (Wied. Ann. 44, 1891), who found that Young's modulus diminished by 4 per cent. in the case of elongations which were less than half those employed by Kyrillov. In the latter's experiments, as will be seen by the figures given below, the variations of E (Young's modulus), do not exceed 1 per cent. when calculated from L_0 and S_0, and are within 0·8 per cent. if based upon L and S.

Thompson's Results.		Kyrillov's Results.			
ΔL	E	ΔL	E	ΔL	E
0	20,050	0	20,779	0	20,614
		0·0012	20,747		
0·0016	19,280			0·0019	20,650
		0·0024	20,677		
		0·0035	20,557	0·0039	20,545

The variations in Thompson's values for E are attributed to his having excluded the possibility of hardening (écrouissage) taking place, by only loading for a few seconds. Kyrillov's results lead one to believe that Young's modulus for a completely hardened wire is constant if the actual length and section are taken as the basis of calculation. L. H. W.

1123. *National Physical Laboratory. Report for the Year* 1906 (pp. 26–61, 1907). (Abstracts in Engineering, 83. pp. 370–373, March 22, and pp. 439–442, April 5, 1907. Electrician, 58. pp. 1011–1012, April 12, 1907.)—Contains a brief account of each of the researches in progress, with especial reference to their newer developments. A repeated impact machine of similar type to that described in Abstract No. 1520 (1906) is now in use for direct tension and compression shock testing. Wind pressure is found in all cases to be about 18 per cent. greater on a large than upon a similar small model. Work is being carried out under the following amongst other heads: Specific heat of superheated steam, Ampère balance, silver voltameter, standard cells and resistances, inductive capacity and resistivity of cellulose, light standards, thermometers, simultaneous comparison of as many as 10 thermo-couples, strength of refractory materials at high temperatures, screw-threads, length standards, behaviour of Cu-Al alloys up to 500° C., structure and behaviour of eutectic alloys, cooling curves of steels. An arrangement for testing photographic shutters is described, and the image of the edge of a bright area given by lenses is being studied. Tide tables are being prepared. The seismographic work at Kew is mentioned, and the examination of thermometers, sextants, and telescopes carried on at Kew indicates a comparative increase in the number of faulty instruments, while the high degree of excellence of watches and chronometers has been maintained. Short descriptions of the following new laboratories are included: Electrotechnical, including photometric; metrological; metallurgy and metallurgical chemistry. F. R.

1124. *New Experiments with the Flame Tube.* **U. Behn.** (Phil. Mag. 13. pp. 627–630, May, 1907.)—The first experiments with the flame tube were made to show the change of air-pressure with height, and for some meteorological demonstrations. It has been elegantly applied by Rubens and Krigar-Menzel in acoustics also. It is now pointed out that to obtain the maximum sensitiveness of the tube its diam. must be not less than 5 cm., and that of the holes not less than 0·5 to 1 cm. Descriptions then follow of the applications of the tube to show the accelerations in pendulum motions and reaction effects. Thus, for a seconds' pendulum, the tube is horizontal, about 0·5 m. long, and has one flame-hole near each end, also its weight is increased by the addition of a saddle-shaped piece of sheet-lead. This bob is then suspended as a pendulum, a gas supply fitted and the jets lighted. Oscillations of 1 cm. amplitude are found to suffice to make the jumping of the flames visible all over a lecture theatre. E. H. B.

1125. *Plurivalent Atoms.* **H. Pellat.** (Comptes Rendus, 144. pp. 969–971, May 6, 1907.)—The author attributes the behaviour of plurivalent atoms to their being built up of a juxtaposition of monovalent atoms. His recent article showing atoms to be nearly spherical, and his direct determination of the ionic charge [see Abstracts Nos. 961 and 1049 (1907)] are also referred to as supporting the present view. E. H. B.

1126. *Viscosity and Poiseuille's Law.* **H. Glaser.** (Ann. d. Physik, 22. 4. pp. 694–720, April 4, 1907. Extract of Inaug.-Dissertation, Erlangen.)—Working with oil of turpentine, the author found that its viscosity decreases steadily as the temperature rises, without showing maxima or minima. The validity of Poiseuille's law depends, in the first instance, upon the width of the tube. Tubes wider than 0·08 cm. gave too high values for the viscosity. Length of tube and velocity of flow are only of secondary influence. Operating with various mixtures of oil of turpentine and colophony, the author found that the viscosity increases very rapidly with the percentage of colophony, especially at the higher values. An increase from 80 to 90 per cent. increases the viscosity 50,000 times. A decrease of temperature from 12 to 7 degrees enhances the viscosity 18-fold. [Compare Abstract No. 787 (1907).] No superior limit of the radius of tube was discovered beyond which Poiseuille's law fails. But there is an inferior limit, which is the higher the greater the viscosity. For $\eta = 10^9$ this limit is 1 cm., for $\eta = 10^5$ it is 0·1 cm. E. E. F.

1127. *Climate of Yukon Territory.* **R. F. Stupart.** (Monthly Weather Rev. 35. pp. 16–17, Jan., 1907. Reprinted from Canad. Inst., Trans. Vol. 8.)—The report concerns the Canadian Yukon territory. Temperature observations have been made partly since 1895 at Fort Constantine, Dawson, White Horse, and other stations, also at Atlin, B.C. The other meteorological observations at Dawson and other stations date back five years and less. Details of the climatic conditions of Dawson are given for each month. The summers of northern and eastern Yukon, which lies lower and is protected by mountains, are warmer than the summers of the southern portions; but the winters are by 15° or 20° F. colder at Dawson than at White Horse. The snowfall in Yukon is about 52 in., the rainfall 7·5 in. H. B.

1128. *Atmosphere of the Northern Arctic Regions.* **Hergesell.** (Comptes Rendus, 144. pp. 1187–1189, May 27, 1907.)—The author accompanied the Prince of Monaco to the Northern Atlantic in July to September, 1906, and conducted the balloon (captive, unmanned, and pilot balloons) and kite ascents from the sea and from Spitzbergen in latitudes 70 to 80° N. The air was found, on the whole, rather warm. The mean temperature gradient up to 7,880 m. was only —0·48° C. per 100 m. The fall of temperature was generally rapid in the layer immediately above the water, in which the humidity rose very high, and which was often covered by clouds. Isothermal strata and inversions were frequent, as the following figures for July 16, lat. 79° N., long. 8° E., show:—Altitudes: 0, 250, 1,200, 1,500, 2,300, 2,560, 3,600, 3,840, 4,200, 7,050, 7,600 m.; temperatures: 7·2, 7·9, 2·1, 4·0, 0·3, 0·6, —5·6, —6·3, —8·5, —28·3, —30·6° C. On another July day a further inversion was met with at 7,000 m. In Spitzbergen kites would not rise above a few hundred m., owing to very persistent cold land winds from the glaciers in the interior, which blew especially with a bright sky, even at night-time. In the long Wijde-Fjord, which penetrates 100 km. into the land from the north, these winds constantly blew from the south at 7 m./sec. But they were confined to the lower strata, purely local, and not observed on the open sea. The winds of the higher strata were strong, blowing at 20 and even 30 m./sec. at an altitude of 10,000 m., but irregular. The western component was the most powerful, easterly winds feeble; winds from the north as frequent as from the south, and a predominating direction could not be observed. H. B.

1129. *The Kingston Earthquake.* **C. F. Marvin.** (Monthly Weather Rev. 35. pp. 5–6, Jan., 1907.)—The bulletin which the U.S. Weather Bureau issued to the press on Tuesday, Jan. 15, 1907, described an earthquake supposed to have taken place at Kingston on that day; but it concerned the earthquake of Jan. 14, news of which was received a day later owing to the complete breakdown of the cables. This bulletin, which is reproduced, is interesting chiefly because the first preliminary tremors were recorded by the N.-S. component seismograph pendulum at Washington, but not at all by the E.-S. component pendulum. Kingston is 1,400 miles from Washington, being almost exactly south, and only 15 min. of arc east of it. If the preliminary tremors are longitudinal or compressional waves, then this motion should not affect the pendulum recording the E.-W. component. It is also noteworthy that the E.-W. vibrations were of relatively greater magnitude, as they should be if the stronger motions are surface vibrations transverse to the direction of propagation. H. B.

1130. *Residual Phenomena illustrating After-shocks of Earthquakes.* **H. Nagaoka.** (Physico-Mathematical Soc., Tokyo, Proc. 4. 3. pp. 66–68, April, 1907.)—The decay in a residual phenomenon of quantity N is expressed by $dN/dt = -\lambda N$, where λ is a constant, for the elastic after-effect, residual electric charge and allied phenomena; but this does not hold if the after-effects influence one another in succession. This is the case of earthquake after-shocks, to which the exponential formula does not apply. The different strata in the earth's crust have different elastic constants and different rates of decay, therefore. The surface stratum is most disturbed, but also comes to rest quickly. The examination of the corrugations in the curves representing the frequency of after-shocks might give us some information concerning the deeper strata, as the behaviour of radio-active substances has been explained from the study of the decay curves. H. B.

1131. *Observation of the Solar Eclipse of Jan. 14, 1907, at Phu-Lien Observatory (Tonkin).* **G. Le Cadet.** (Comptes Rendus, 144. pp. 883–885, April 29, 1907.)—The eclipse was partial in Indo-China, its magnitude at Phu-Lien being 0·58. The sky was clear, and definition perfect. The author observed the times of contact with a telescope of 12·9 cm. aperture furnished with cross-wires. The chronometer rate was known from regular comparisons, and was tested in addition by means of a series of solar altitudes measured with a theodolite before and after the eclipse. The moon's limb did not reach the great spot group in the S.E. quadrant. The following times were noted: First contact, 0h. 37m. 28·3s.; last contact, 3h. 8m. 16·3s.; contact with a small spot near sun's west limb, 0h. 42m. 43s. These times are expressed in mean time of the place of observation, the adopted co-ordinates of the place being: longitude E. of Paris, 6h. 57m. 9·0s.; latitude N., 20° 48′ 25″; altitude, 100m. A Violle's actinometer showed a lowering of radiation. At the moment of maximum the difference of temperature of the balls, which would normally have been 10°, fell to 4·9°. The air temperature showed a fall of 2·5° below the normal, as deduced from a curve for the fine days of January. The fall was accompanied by a correlative increase in relative humidity. The diurnal oscillation of the barometer, generally regular in those regions, was disturbed. The pressure rose before attaining the regular minimum, and then remained at about 0·6 mm. above it. Some stress is laid on the possible interest, in connection with the mechanics of the atmosphere, of such barometric observations during eclipses in tropical regions. A. E.

1132. *Absence of Polarisation in the Solar Prominences.* **P. Salet.** (Comptes Rendus, 144. pp. 1147–1148, May 27, 1907.)—A short note calling attention to an apparent contradiction between the theories of Schmidt and of Julius and Fresnel's polarisation theory. According to Schmidt's theory, a ray coming from a point of the solar disc has already undergone strong deviation in the sun itself, due to successive refractions in the plane through the ray and the sun's centre. It ought, therefore, to be partially polarised perpendicularly to this plane, the quantity of light polarised depending, in Fresnel's theory, only on the value of the deviation. Again, according to Julius' theory, a monochromatic ray from a point of a prominence comes in reality from a point of the photosphere, and therefore ought to be polarised perpendicularly to the plane passing through the ray and the point of origin. But, it is stated, the light from the sun's limb and from the prominences is *not* polarised. On a polariscope photograph of very short exposure taken by the author in 1905, polarised light was found on the corona for the first time close to the moon's limb, and yet no trace of polarisation was observed on the prominences. [See Abstract No. 31 (1906).] A. E.

1133. *Photometric Observations of Jupiter's Satellites.* **P. Guthnick.** (Preuss. Akad. Wiss. Berlin, Sitz. Ber. 18. pp. 339–363, 1907.)—The observations, over 1,000 in number, were made from July, 1905, to April, 1906, with a Zöllner photometer attached to the 11-in. refractor of Bothkamp Observatory, and form the continuation of a former series in 1904–5, which were discussed in a communication of that Observatory. The divergence between the light-curves drawn from the two series is considerable, the variations being, in the author's opinion, mainly due to physical processes on the satellite surfaces. An attempt is made to trace laws of periodicity and to find the causes governing the very large variations. The possible effects of surface patches of unequal reflecting power, deviation from spherical form, inclination of equatorial planes, physical disturbances on the primary solar action, &c., are discussed. The author, however, is forced to the conclusion that no satisfactory solution can be reached until observations have been continued throughout at least one revolution period of Jupiter. A. E.

1134. *Distances of the Satellites of Uranus and Jupiter.* **E. Belot.** (Comptes Rendus, 144. pp. 885–887, April 29, 1907.)—The author applies his law of distribution [Abstract No. 281 (1906)] to the systems of Uranus and Jupiter. The two-parameter formula for Uranus is $x_n - 4·9 = 1·496^n$, and for Jupiter $x_n - 0·8 = 1·717^n$, n denoting the order reckoning outwards from the planet. The distances of the four known satellites of Uranus agree with the distances obtained for the author's Nos. 2, 4, 6, 8, by the formula. Three of the satellites observed by Herschel, and not seen since, agree fairly well with Nos. 5, 7, 9 in the author's series when Herschel's distances are reduced in accordance with the present acceptation of the diam. of Uranus. In Jupiter's system, Barnard's satellite V. ranks as No. 1; the well-known large satellites I., II., III., IV. as Nos. 3, 4, 5, 6; and VI., VII. as No. 9. A discordance between theory and observation in the case of VI. and VII. is explained by the angle, 32°, which their plane makes with the plane of the other satellites. The author suggests that the acceleration of perijove of sat. V. found by Barnard may be due to satellite masses at distance 3·747 corresponding to No. 2. A discrepancy in the case of sat. III. is accounted for by supposing that the theoretical distances are the primitive distances, which have been subjected to slight variations owing to mutual attractions. It is then found that the differences between the calculated and observed distances for satellites I., II., III. are in accordance with Laplace's relation connecting the variations. A. E.

1135. *Currents in the Stellar System.* **J. C. Kapteyn.** (Archives Néerlandaises, 11. pp. xxxii–liv, 1906. Paper read before the General Meeting of the Dutch Society of Science, May 19, 1906.)—The distribution of the motions of the stars on the celestial sphere is represented by the following graphic method. From the centre S of each star group twelve radii vectores are drawn at equal angular distances, the length of each radius being equal to the sum of the displacements of the stars in the adjacent half-sectors. The extremities of the radii vectores are then joined, forming a twelve-sided figure. If the star motions are quite at random this dodecagon should possess a single axis of symmetry passing through S and the apex A of the sun's way, and a single maximum radius in the direction opposite to the apex A. To facilitate comparison the figures are divided into four sector of alternately 60° and 30°, coloured alternately black and white. In reality the dodecagons are found not to possess the above properties, but to present two axes of symmetry, and two maximal radii, thus showing that the motions do not take place at random, but follow an ordered law. The most characteristic figures are all obtained in the vicinity of the poles of the Milky Way, are nearly identical, and are complementary in character for the two poles. The conclusion is drawn that two great main currents exist in the universe, whose *apparent* directions form an angle of 140° (distance of points of divergence). When, however, the motion of the solar system is allowed for, the directions of the two currents are found to be diametrically opposed, one stream being directed towards ξ Orionis, and the other towards the opposite point of the heavens. The motion of the solar system is found to be towards the constellation Hercules, in accordance with the usual assumption. The author does not claim that all stars move exclusively in one or other of the above directions, but only that more stars move in these directions than in others. The number of stars whose direction of motion deviates from the main streams diminishes as the deviation increases. The mutual penetration of the two streams, which must have been going on for millions of years, has probably caused collisions or approaches which have set the colliding bodies in revolution about one another. It is suggested that the peculiar properties of the helium stars may be attributable to some such phenomenon. Speculation arises as to the relation between the streams and the Milky Way, and as to whether the two streams were originally independent, or arose from the primitive form and distribution of density in a single nebula. The author expresses regret that the rich observational data accumulated by the Lick Observatory have not been made available for the purpose of testing his theory. A. E.

REFERENCES.

1136. *Apparatus for Copying Edison Records on the Discs of the Archives Phonograph.* **F. Hauser.** (Akad. Wiss. Wien, Sitz. Ber. 115. 2a. pp. 779–784, June, 1906. Eighth Report of Phonogram Archives Commission.)

1137. *Areometers.* **L. Marini.** (Accad. Lincei, Atti, 16. pp. 305–315, March 3, 1907.)—Compares the advantages of total-immersion and partial-immersion areometers in measuring the density of sea-water. With suitable precautions, partial-immersion areometers are capable of yielding results to the fourth decimal, and are quite as accurate as the total-immersion areometers recommended by Nansen, which have sources of error of their own. E. E. F.

1138. *Elastic Constants of Metals.* **E. Grüneisen.** (Ann. d. Physik, 22. 5. pp. 801–851, May 2, 1907. Communication from the Physikal.-Techn. Reichsanstalt.)—Gives a more complete treatment, with detailed experimental results, of the work referred to in Abstracts Nos. 8 and 773 (1907). F. R.

1139. *Stability of Submarines.* **J. G. Johnstone.** (Inst. Engin. and Shipbuilders, Trans. 50. 4. (pp. 28–47); Discussion, 50. 5. (pp. 1–7); 50. 6. (pp. 9–15) 1906–1907.)—The institution of tank experiments on stability is urged by the author in this paper, which treats the subject both from the theoretical and the practical point of view. L. H. W.

1140. *Application of Photogrammetry to the Goniometry of Crystals.* **S. Nakamura.** (Physico-Mathematical Soc., Tokyo, Proc. 4. 3. pp. 56–66, April, 1907.)—Suitable for the measurement of the angles of crystals having no reflecting surfaces.

1141. *Motion of Viscous Liquids.* **M. Smoluchowski.** (Acad. Sci. Cracovie, Bull. 1. pp. 1–16, Jan., 1907.)—A mathematical consideration under the headings: Conditions which suffice to determine the motion; Motion in two dimensions.

1142. *Apparent Elongation of Comets' Tails.* **J. Holetschek.** (Akad. Wiss. Wien, Sitz. Ber. 115. 2a. pp. 1451–1474, Nov., 1906.)—Discussion of an apparent extension of cometary tails produced by the passage of the earth through the plane of the comet's orbit. C. P. B.

1143. *Star Image in Spectrographic Work.* **J. S. Plaskett.** (Astrophys. Journ. 25. pp. 195–217, April, 1907.)—Description of a series of experiments on the size and form of the star image given by the combination of objective and correcting lens of the 15-in. telescope of the Dominion Observatory, Ottowa. Various difficulties were found owing to imperfections in the system, the cause of which was finally located in the correcting lens. Useful comparison tables giving constants of other large spectroscopic equipments are included in the paper. C. P. B.

1144. *Magnitudes and Position of Nova Geminorum.* **E. E. Barnard.** (Roy. Astronom. Soc., Monthly Notices, 66. pp. 355–361, April, 1906.)

LIGHT.

1145. *Experimental Proof of Doppler's Principle for Light.* **B. Galitzin** and **J. Wilip.** (Acad. Sci. St. Pétersbourg, Bull. 8. pp. 218–228, May 1, 1907.)—As source of light an Arons' mercury arc lamp was used, and from its spectrum the green line ($\lambda = 5461$Å.U.) and the indigo-blue line ($\lambda = 4358$Å.U.) were chosen. The light passed through an auxiliary spectroscope to the Michelson echelon, and the bands were photographed. By means of rotating mirrors the band for one-half the field could be photographed with an approaching motion of the source, and afterwards the same band for a recessional motion was photographed on the other half of the field. The displacement between the two bands accordingly corresponded to double the speed used, which was of the order 250 m. per sec. This speed, as estimated from the displacement and from the number of turns per sec., showed a mean discrepancy of 20 m. per sec., which is held to establish the principle within the limits of experimental errors. E. H. B.

1146. *Stationary Radiation in a Hollow Space in Uniform Motion.* **K. v. Mosengeil.** (Ann. d. Physik, 22. 5. pp. 867–904, May 2, 1907. Dissertation, Berlin.)—In the forefront of physical problems stand the electrodynamics and optics of moving bodies, to which up to now no final solution has been given. All experiments seeking to establish an influence of the earth's motion upon electrodynamic phenomena have given negative results. In order to explain this, H. A. Lorentz and, in a yet more general manner, A. Einstein [see Abstract No. 2277 (1905)] have introduced the principle of relativity, according to which it is impossible to find such an influence. A support for Lorentz's theory, F. Hasenöhrl considered he had found [see Abstract No. 998 (1905)]. For he thought he had succeeded in finding an apparent exception to the second law of thermodynamics, which would, however, be removed on Lorentz's hypothesis. The present author believes Hasenöhrl's work to be fallacious, apart from the error of calculation discovered in it by Abraham. The paper then becomes mathematical, and concludes with the following statement: "We therefore need, as we have seen, no new hypothesis in respect to the change of length of moving bodies, in order to bring the laws of stationary radiation in a moving hollow space into harmony either with electrodynamics or thermodynamics (as Hasenöhrl held to be necessary). Whether the principle of relativity (also for material bodies) is correct still remains an open question, untouched by the result of the present investigation." E. H. B.

1147. *Comparison of the International Units of Luminous Intensity.* **E. P. Hyde.** (Bureau of Standards, Bull. 3. pp. 65–80, April, 1907. West. Electn. 40. pp. 485–486, June 1, 1907. Abstract.)—In America the Hefner lamp is taken as the primary standard, but the luminous intensity of a source is expressed in British parliamentary candles (using the ratio 1 Hefner = 0·88 British candle). Recent experiments, however, have not confirmed this number. It is 2 per cent. different from that obtained from the Bureau of Standards glow-lamps. If the British candle be taken as one-tenth the intensity of the Harcourt (10-c.p.) pentane lamp at the National Physical

Laboratory, according to the values assigned the Bureau of Standards glow-lamps, it is 2 per cent. different from the candle in America obtained from the Hefner lamp by means of the ratio 0·88. If the British candle be taken as one-tenth the intensity of *any* (10-c.p.) Harcourt lamp, experimental results show that it is sometimes 5 or 6 per cent. different from the British candle used in America. Whatever the amount of the difference, it would seem that the candle in use in the photometry of electric lamps in the U.S.A. is sufficiently different from the British candle, as obtained through Harcourt (10-c.p.) pentane lamps, to justify the unit obtained through the Hefner by use of the ratio 0·88 being called the *candle* instead of the *British candle.* The author calls attention to the approximate agreement between the bougie décimale, the British candle, and the candle in use in the U.S.A. for the testing of electric lamps. The difference of about 2 per cent. is small compared with the ordinary inaccuracy of industrial photometry, and so no serious results would follow a compromise by which the three countries would agree upon a common unit. He points out that this highly desirable end becomes more difficult of accomplishment every year owing to the rapid increase in the accuracy of photometric measurement, and even now a change in the unit of over 1 per cent. would be felt in the United States. As soon as an entirely satisfactory standard of light is invented its general adoption will probably follow at once. The adoption of a common standard, however, is not nearly as important as the adoption of a common unit. In the following table the ratios (A) of the Harcourt (10-c.p.) to the Hefner, (B) of the Carcel to the Hefner, and (C) of the Harcourt (10-c.p.) to the Carcel, as found by recent tests, are given :—

	A.	B.	C.
Reichsanstalt (using an electric comparison lamp) ...	10·9	10·7	1·02
Laboratoire Central (using an electric comparison lamp)	10·76	10·76	1·00
Laboratoire Central and Laboratoire d'Essais (direct comparison)..........	10·72	10·73	1·009
National Physical Laboratory..........	10·95	10·69	1·024
Ratios computed from Bureau of Standards glow-lamps	11·19	10·73	1·048
Best previous values (Bunte)	11·4	10·87	1·05

A. R.

1148. *Geometrical Theory of Radiating Surfaces.* **E. P. Hyde.** (Bureau of Standards, Bull. 3. pp. 81–104, April, 1907.)—Theoretical photometry assumes two general laws of radiation. (1) The inverse square law, which on the assumption of the rectilinear propagation of light is merely a statement of a geometrical property, and (2) Lambert's cosine law. The latter is an empirical law, based primarily on the observation that a uniformly bright sphere, when viewed at a distance, appears as a uniformly bright disc. No satisfactory experiments have yet been made to test the law in its application to glowing surfaces. It apparently follows from Kirchhoff's law that it can only be rigorously correct for a black body. The inverse square law is true for a point or a spherical source only, and the cosine law is always assumed as applicable primarily to the infinitesimal elements of a surface. Errors of considerable magnitude may therefore arise in practice when applying them to extended luminous surfaces. The author finds the errors made on the usual assumptions for the cases of a luminous cylinder and a luminous circular disc. He uses the term "specific luminous flux" instead of the term "illumination," which was defined at the Geneva Congress as the luminous flux across a given surface, divided by the area of the surface. He also introduces the idea of "tubes of light," and functions are derived for the light-field analogous to potential and intensity in the electrostatic field. At the Geneva Congress the luminous flux was defined as the intensity of the source multiplied by the solid angle subtended at the source by the given surface. As this definition is applicable to point sources only, the author defines the luminous flux across a given surface as "the quantity of luminous energy flowing normally across the surface in 1 sec." The intensity of illumination $= d\Phi/dS$, where $d\Phi$ is the luminous flux across the area dS. This always presupposes a material screen. The resultant flux per unit area across any imaginary surface may be zero, whereas the illumination on the two sides of a material screen coincident with the imaginary surface may be large, if it is the same on both sides of the screen. Since in the problem of the light-field this unique property of the possible separation of the positive and negative flux across a surface is found, it is desirable, in considering the light-field in its analogy to the electrostatic field, to employ the term "*luminous flux per unit area*" rather than the more special term "illumination." At every point in space there is some definite direction in which the flux of luminous energy is a maximum. The specific luminous flux at a point is defined as "the quantity of luminous energy which flows in 1 sec. normally across a surface of unit area placed perpendicular to the direction of maximum flux." Assuming the rectilinear propagation of light, the author by means of the function representing the specific luminous flux maps out the light-field round an infinitely long radiating strip of uniform specific light-intensity. The lines of maximum light-flux and the corresponding "equipotential" lines in a plane perpendicular to the length of the radiating strip are found to be confocal hyperbolas and ellipses. A diagram is drawn illustrating the deviation from the cosine law at various distances from the strip in a direction in the plane perpendicular to the strip, and making an angle of 45° with it. The error increases rapidly to a maximum value of about 25 per cent. It then diminishes rapidly. A. R.

1149. *Visibility of Röntgen Rays.* **D. Bossalino.** (Archiv. ital. de biol. 46. pp. 68–72, 1906. Journ. de physiol. et de pathol. général, Jan. 15, 1907.) —Under certain circumstances (adaptation to darkness and use of blindfolding bandage) the Röntgen rays are visible to the normal and cataract-afflicted human eye. By means of the rays the shape of metallic objects interposed between the eyes and the Röntgen-ray tube can be made out. The perception of the radiations is due to the retina, the fluorescence of which latter is provoked by the rays. L. H. W.

1150. *Oxidisers and the Latent Image.* **J. Sterry.** (Photographic Journ. 47. pp. 170–173; Discussion, pp. 173–175, March, 1907.)—Vidal correctly concluded [Abstract No. 1817 (1904)] that bathing a plate in potassium bichromate between exposure and development does not destroy the latent image; it may make it more difficult to develop, but the highest number which can be developed remains the same. The action of light appears to be (1) a molecular change, with formation of a product whose development is very rapid but is greatly hindered by oxidisers, which is itself untouched by oxidisers and which is probably soluble in the fixing bath; (2) a partial breaking up of the haloid, forming a rapidly developable product, which is prevented from development by oxidisers and which is insoluble in the fixing bath until oxidised; and (3) complete breaking up of the haloid with liberation of halogen, forming an undevelopable product untouched by oxidisers and insoluble in the fixing bath. The last of these products appears at the latest at about the beginning of the reversal period; and the liberated halogen appears to prevent the development of the product (2), and may therefore be the cause of reversal. Probably the image can be reinforced from portions of the plate which were not exposed (secondary development). In the *discussion*, **Mees** objected to this last idea; perhaps two nuclei exist in the plate after exposure, the one an atom of silver, the other the envelope of gelatine in which it is enclosed; the former destructible, the latter indestructible by chromate salts. A. D.

1151. *Colour Sensitising.* **T. T. Baker.** (Photographic Journ. 47. pp. 207–214; Discussion, pp. 214–218, April, 1907.)—A dye can merely augment, it cannot create, colour sensitiveness in a plate. If it actually forms a definite compound with the silver salts in the film the case is different, but chemical combination is not always necessary. The theory that dyes sensitise to the spectral regions which their solutions absorb does not hold good; many do, many do not. Particular examples are discussed Any aniline or other dye whatsoever is capable of enhancing the sensitiveness of AgBr to some portion of the spectrum. Practically all aniline dyes whose ammoniacal solutions are very slightly active show distinctly greater action when used in conjunction with $AgNO_3$. Dyes presenting several absorption bands are generally the more active, and dyes confer as many maxima of colour-sensitiveness as they possess transmission bands. The relation between absorption bands and maxima or minima of colour-sensitiveness appears to vary with different chemical constitutions. Metallic electrolytes other than $AgNO_3$ do not influence the sensitising action of the dyes, except where they act as mordants or otherwise alter their transmission spectra, or are alkaline in character. Methods are suggested for measurement of the general sensitiveness of a dyed plate and for finding the extreme limit of action usable in spectrography. In the *discussion*, **Mees** said the consensus of opinion seemed to be that dyes really do sensitise for the region in which they absorb; not necessarily the region in which their aqueous solutions absorb, but the region in which the dyed plates absorb, which is usually more towards the red than the former. A. D.

1152. *Band Spectra.* **L. J. Kordyš.** (Jurn. Russk. Fisik.-Chimičesk. Obščestva, 38. No. 2. Physical Part, pp. 96–119, 1906.)—The author supports the view that band spectra are formed when the temperature and the degree of rarefaction are sufficient to start the dissociation of the molecules of the elements, whilst a line spectrum is produced by a more complete splitting up of the molecules into independent atoms. This view is held to be corroborated by a large number of researches by different observers, which are quoted. The same considerations are applicable to the spectra of compounds. L. H. W.

1153. *Temperature Variation of Absorption Bands of Crystals and of Damping of Absorbing Electrons.* **J. Becquerel.** (Comptes Rendus, 144. pp. 1032–1035, May 13, 1907.)—It is known that the absorption bands of crystals retain a fixed position in the spectrum but change their appearance as the temperature varies, becoming faint and soft if the body is heated, but, on the contrary, at low temperatures assume extreme sharpness and intensity. The possible reason for this behaviour is now examined mathematically, and the results compared with experiment. This comparison prompts the author to enunciate the following law: "The damping of the vibratory motion of the electrons absorbing the light is practically proportional to the square root of the absolute temperature." E. H. B.

1154. *Absorbing Power and Fluorescence of Resorufin.* **F. G. Wick.** (Phys. Rev. 24. pp. 356–378, April, 1907.)—Experiments were made to determine whether the typical fluorescence spectrum changes with the concentration, or whether the shift of the maximum of the spectrum towards the longer wave-lengths with increase of concentration is caused by absorption only. A Lummer-Brodhun spectrophotometer was used. The paper is illustrated by many curves and tables of the absorption coefficients measured, the results being classed under the heads absorption and thickness, absorption and concentration, and fluorescence and concentration. These results are summarised as follows: (1) Fluorescent solutions are optically perfect substances, *i.e.*, they obey Lambert's law. (2) Beer's law, *i.e.*, that increase of concentration is equivalent to increase of thickness, is true for dilute but not for concentrated solutions. (3) A change in the concentration of a fluorescent solution has no effect upon the typical fluorescence spectrum. [See also Abstract No. 1164 (1907).] G. E. A.

1155. *Phosphorescence of Manganiferous Calcium Compounds: Determination of the Optimum.* **L. Bruninghaus.** (Comptes Rendus, 144. pp. 839–841, April 22, 1907.)—The author gives the results of an examination of the phosphorescence produced in mixtures of calcium and manganese salts in various proportions by kathodic fluxes of equal intensities, the calcium and manganese salts employed being the oxides, sulphates, phosphates, and sulphides. The variations in the phosphorescence are found to lie mainly in the intensity, the colour varying but little. For the four compounds examined the intensity at first increases with increase of the manganese salt, but reaches a maximum when the mixture contains 0·5 of manganese oxide per cent. of total metallic oxide. The varying nature of the acid radicals does not modify the position of the optimum of phosphorescence, which seems to be a constant characteristic depending solely on the ratio between the numbers of atoms of Mn and Ca—a ratio which has the value 1 : 254. T. H. P.

1156. *Triboluminescence of Substances containing Zinc.* **A. Karl.** (Comptes Rendus, 144. pp. 841–843, April 22, 1907.)—The author describes the preparation of substances which exhibit practically no phosphorescence after exposure to the air, but which are triboluminescent to such a degree that, when crushed with a glass or metal rod, the light emitted is observable in ordinary daylight. This triboluminescence is visible under water, carbon disulphide, ether, &c., or in evacuated tubes of hydrogen or nitrogen. The substances are obtained by heating at a high temperature mixtures of zinc sulphide or oxide with a number of different compounds, such as silicic, stannic, or titanic acid, zirconia, praseodymium oxide, manganese nitrate, silicate, stannate, titanate or zirconate, &c. Analyses of a number of the products give results incompatible with chemical formulæ, and it does not seem absolutely certain that the property of triboluminescence is due to the presence of definite compounds. T. H. P.

1157. *Disintegration Constant of Radio-thorium.* **G. A. Blanc.** (Accad. Lincei, Atti, 16. pp. 291–296, March 8, 1907. Phys. Zeitschr. 8. pp. 321–324, May 15, 1907. Translation. Écl. Électr. 51. pp. 415–416, June 22, 1907.)—The specimen was extracted from Echaillon mud. Its period of half-disintegration was found to be 787 days, the longest yet measured in any radio-active substance. E. E. F.

1158. *Radio-activity of Lead.* **J. Elster and H. Geitel.** (Phys. Zeitschr. 8. pp. 273–277, May 1, 1907. Écl. Électr. 51. pp. 416–417, June 22, 1907.)—The authors have attempted to identify the active radiation in the case of chemically precipitated lead [see Abstract No. 72 (1907)] by determining the rate of decay of activity and the range of the α-rays in air. The observations for determining the rate of decay extend over 151 days, and the decay is found to be approximately logarithmic, the activity falling to one-half in about 100 days. The apparatus for determining the range of the α-particles is described, and also the precautions taken and sources of error. The range is found to be 4 to 5 cm., while that for the α-particles from RaF is 3·9 cm. The determinations could not be made with an accuracy of 1 mm., so the result is not conclusively in favour of the identity of the active substance and RaF. [See also Abstract No. 71 (1907).] S. G. S.

1159. *Total Ionisation of various Gases by α-Rays from Uranium.* **T. H. Laby.** (Roy. Soc., Proc. Ser. A. 79. pp. 206–219, May 14, 1907.)—Two plates are fixed at a distance apart greater than the range of the α-rays and the total ionisation between them, for different gases, is compared with that produced in a standard vessel containing air. The thin layer of U_3O_8, which serves as ionising agent, is spread over the lower plate; the correction for the ionisation produced by the β- and γ-rays is shown to be negligible. The total relative ionisation produced in various gases and vapours is shown in tables; they agree very closely with Bragg's results, which were obtained by a different method using RaC. It follows that the total relative ionisation is independent of the range and velocity of the α-particle. No agreement is found between the author's results and those calculated by Strutt's density rule. R. S. W.

1160. *Effect of High Temperatures on Radium Emanation.* **W. Makower and S. Russ.** (Roy. Soc., Proc. Ser. A. 79. pp. 158–166, May 14, 1907.)—An account is given of a continuation of previous experiments [see Abstract No. 719 (1906)] on the behaviour of radium emanation when subjected to temperatures between 1,000° C. and 1,200°. The radium emanation was sealed up in a quartz tube; after an interval its activity was measured; it was then heated to 1,100° C. and kept at that temperature for one hour, after which it was removed for a few min., and on testing its activity this was found to have fallen about 6 per cent. Details of the observations in successive experiments are given in tables and diagrams. The authors conclude that: (1) The change in activity noticed when radium emanation is subjected to a high temperature is not due to any alteration in the emanation itself, since its time period is unaltered when it is maintained at a temperature of 1,100°. (2) The change is due *either* to a change in radium B or C, since the activity of a mixture of these two substances can be changed by heating. (3) The change is *probably* due to some influence of temperature on radium C. In a note reference is made to the experiments of Bronson, who concludes that there is no change of activity in radium, even when exposed to a temperature of 1,600° C. The change of the activity observed when the emanation is heated in a quartz tube and allowed to cool he regards as only apparent. Bronson's experiments were made on radium itself, those of Makower and Russ on the active deposit. Bronson measured the activity of the radium while hot, whereas the authors always allowed the active deposit to cool before making measurements, and they consider that their own experiments and those of Bronson are not necessarily contradictory.

J. J. S.

1161. *Ionisation by α-, β-, and γ-Rays.* **R. D. Kleeman.** (Roy. Soc., Proc. Ser. A. 79. pp. 220–233, May 14, 1907.)—Assuming that it requires the same amount of energy to make an ion from an atom, whether it is free or combined with other atoms, the total ionisation produced by α-rays in any gas is found to be an additive property of the constituent atoms. Taking the published experimental results of various observers, the agreement between calculation and experiment for various gases and vapours is as good as can be expected except in the cases of SO_2, NH_3, and H_2. The α-particle spends the least amount of energy per ion in sulphur and the greatest in nitrogen, although it does not follow that all the energy spent goes to produce ions. Experiments here described show that ionisation by γ-rays is also an additive property of the atom with the same three exceptions as before, and in such cases as this law holds, the energy spent per ion is independent of chemical combination. Similar results are found for β-rays. Curves are given showing the atomic ionisation produced by α-, β-, and γ-rays plotted against the atomic weight. These show a series of similar maxima and minima, and it appears that the atomic ionisation is a periodic function of the atomic weight.

R. S. W.

REFERENCES.

1162. *Polarimeter.* **O. Lummer** and **R. Kynast.** (Ann. d. Physik, 22. 4, pp. 721–725, April 4, 1907. Phys. Inst. d. Univ., Breslau, Jan., 1907.)—Describes an instrument specially adapted to the measurement of optical phase-differences.

E. E. F.

1163. *Luminous Efficiency of Incandescent Lamps.* **W. Voege.** (Phys. Zeitschr. 8. pp. 306–307, May 1, 1907.)—Referring to Russner's paper [Abstract No. 408 (1907)], the author points out that the results obtained by him are inconclusive, as the lamps experimented on were not all supplied at their normal voltage, some having been overrun and others underrun.

A. H.

1164. *Fluorescence Absorption in Resorufin.* **F. G. Wick.** (Phys. Rev. 24. pp. 407–420, May, 1907. Paper read before the Amer. Phys. Soc., June, 1906.)—Nichols and Merritt had found that during fluorescence a substance acquires the temporary power of absorbing the same wave-lengths as it emits, but Camichel failed to find any such change, throwing doubt on the existence of the phenomenon [see Abstracts Nos. 1019 (1904) and 531, 1002, 1866 (1905)]. The experiments described go to confirm the work done by the former investigators. [See also Abstract No. 1154 (1907).]

G. E. A.

1165. *Action of Radium and certain other Salts on Gelatine.* **W. A. D. Rudge.** (Roy. Soc., Proc. Ser. A. 78. pp. 380–384, Dec. 20, 1906.)—Further particulars confirmatory of the view previously expressed [Abstract No. 1399 (1906)].

HEAT.

1166. *Absorption of Water by Cotton and Wool.* **M. W. Travers.** (Roy. Soc., Proc. Ser. A. 79. pp. 204–205, May 14, 1907.)—In Trouton's experiments [Abstract No. 914 (1906)] the material was dried at the air temperature, and hence it is possible that the true origin of the curves giving pressure and concentration was not obtained. Drying at 100° the experiments have been repeated, and this is found to be the case. The curves obtained resemble those for CO_2 and amorphous carbon [see Abstract No. 2126 (1906)].

R. S. W.

1167. *Establishment of the High-temperature Scale.* **C. W. Waidner** and **G. K. Burgess.** (Phys. Rev. 24. pp. 441–444, May, 1907. Communication from the National Bureau of Standards.)—The scale which is used by the Reichsanstalt and the National Physical Laboratory is reproducible in the range 400° to 1,200° C., with differences of less than half a degree from the fusing-points of the Sn, Zn, Cu, and Au sold as chemically pure without further purification. For the optical extension of this scale a black body was constructed, the radiation from which indicated temperatures not differing by more than 1° at 1,300°, and by the use of absorbers this scale has been extended to 1,500° with an uncertainty of 2°. The radiation from Pt and Pd was studied and also their melting-points; these were found, on extrapolation from Wien's equation, as 1,546° and 1,753° respectively when c_2 is taken as 14,500, or 1,555° and 1,760° if c_2 is 14,200 [see Abstracts Nos. 80 and 437 (1907)].

R. E. B.

1168. *Variation of Gaseous Viscosity with Temperature.* **W. J. Fisher.** (Phys. Rev. 24. pp. 385–401, May, 1907.)—As Sutherland's theoretical relation may be put into the form $\theta = K(\theta^{\frac{3}{2}}/\eta) - C$, the locus of points with $\theta^{\frac{3}{2}}/\eta$ and θ for co-ordinates should be a straight line for the range in which the relation holds good; this is found to be the case when the observations of v. Obermayer, Breitenbach, Schultze, Markowski, and others are examined. Examination of the values of C and K obtained for nitrogen, oxygen, and argon gives the relations $C = 0{\cdot}058M^2 + 74$ and $10^7K = 0{\cdot}593M^{\frac{1}{2}} + 66$, where M is the molecular weight; these results are not quite in accordance with Sutherland's theory, and, while the former suits helium also, the latter does not.

R. E. B.

1169. *The Two Methods of Liquefying Air by Expansion.* **G. Claude.** (Comptes Rendus, 144. pp. 1037–1039, May 13, 1907.)—If the expansion is accompanied by recoverable external work, as much as 0·9 litre of liquid air per h.p. can be obtained [see Abstract No. 1411 (1906)], no higher pressure than 40 atmos. being used. If, however, it is effected without the performance of external work, *i.e.*, with internal work only, scarcely 0·6 litre per h.p. can be obtained even with powerful machines and with an initial pressure of 200 atmos. The reasons for this difference are discussed.

R. E. B.

1170. *Rate of Combustion and Pressure developed in a Calorimetric Bomb.* **F. G. Benedict** and **F. P. Fletcher.** (Amer. Chem. Soc., Journ. 29. pp. 739–757, May, 1907. Contribution from the Chem. Lab. of Wesleyan Univ.)—The authors state that calorimetric bombs are usually made with a much larger factor of safety as regards thickness of metal than is demanded by the pressures generated within them, and their investigation was carried out in order to obtain scientific data for their improvement in this respect. The apparatus used in their experiments was a Berthelot-Atwater bomb calorimeter, the valve opening of which was connected to a sensitive pressure gauge reading up to 1,100 lbs. The materials were weighed and placed in a capsule supported inside the bomb, which was then filled with oxygen gas at various pressures. The ignition was effected by heating a fine iron wire. Typical materials such as gunpowder, sugar, benzoic acid, cellulose blocks, plasmon, and olive oil were used in the experiments. The results are summarised by the authors as follows: (1) With an initial pressure in the calorimeter of 300 lbs. the pressure in the bomb rarely exceeds 700 lbs. (2) The greater the weight of material used, the greater the pressure, although the pressure is not proportional to the weight of substance. (3) The greater the initial pressure the greater the max. pressure observed, but there is no regularity or proportion in this relationship. (4) The use of a medium-sized capsule for holding the combustible material has a distinct tendency to decrease the max. pressure observed, and to retard the combustion. (5) The pellet form of material which is sometimes employed in calorimetric work, in all cases when used by the authors, decreased the max. pressure and retarded the combustion. (6) The incorporation of inert material is without any appreciable effect upon the max. pressure, but markedly retards the rate of combustion. (7) Anthracite coal gives a low max. pressure with a slow rate of combustion, which is in sharp contrast to the results obtained from bituminous coal. J. B. C. K.

1171. *Explosion of Pure Electrolytic Gas.* **H. B. Dixon** and **L. Bradshaw.** (Roy. Soc., Proc. Ser. A. 79. pp. 234–235, May 14, 1907.)—Experiments made in 1902 and 1903 on the explosion of moist and dry mixtures of hydrogen and oxygen in narrow tubes about 18 in. long, fired in the middle, are here recorded, and it appears that, as far as can be judged from the flame, the absence of water-vapour does not influence the explosion once the flame has been started by a spark. R. E. B.

1172. *Firing of Gaseous Mixtures by Compression.* **L. Bradshaw.** (Roy. Soc., Proc. Ser. A. 79. pp. 236–241, May 14, 1907.)—In addition to the ordinary effects accompanying the explosion of mixtures of hydrogen and oxygen, the photographs taken in the experiments recorded in the previous paper showed a new luminous wave advancing from the constricted end of the explosion-tube to meet the flame spreading slowly from the firing-point. Experiments with tubes with differently shaped ends of different rigidness showed that two of the essential conditions for the setting up of this wave are that the end of the tube must be funnel-shaped and unyielding, the phenomenon being thus analogous to the tidal bores occurring in constricted estuaries; the distance of the end from the firing-point must also be less than that required for the development of the detonation-wave. It seems then that the mixture is fired at the funnel-end on arrival of a wave of compression, the speed of propagation of which was found to be on the average that of sound in the explosive mixture; and it was calculated that in the experiments the pressure due to the compression would need to be at least 18¼ atmos. [the data really give 38¾] in order to ignite the mixture by the adiabatic rise of temperature produced. R. E. B.

1173. *Speed of Detonation by Explosives.* **Dautriche.** (Comptes Rendus, 144. pp. 1080–1082, May 18, 1907.)—The method of experimenting described in Abstract No. 2047 (1906) has been slightly modified so that only a few cm. of the explosive are needed and the compensating fuses are dispensed with. As before, the speed of detonation is greatest for a particular value of the density, the critical speed for dynamite No. 1 being 8,794 ft. per sec. at the density 1·62; and the speeds are greatest, especially at small densities, for explosives like guncotton and picric acid that are but slightly compressible. The sensibility of the fulminate is sensibly constant for densities less than the critical, but falls off very rapidly as the density becomes greater than this, so that if high densities are employed with mines large detonating charges have to be used. The speed of propagation of the disturbances produced in air close to exploding dynamite is found to be 9 times that of sound: and the crushing effects of the explosion do not seem to depend on the speed of detonation only. R. E. B.

1174. *Law of Burning of Modified Cordite.* **J. H. Mansell.** (Roy. Soc., Phil. Trans. Ser. A. 207. pp. 243–262, May 31, 1907. Proc., Ser. A. 79. pp. 397–398, July 10, 1907. Abstract.)—Vieille's law of the combustion by parallel surfaces for smokeless propellants (a propellant being an explosive which explodes and does not detonate) is here investigated, the explosive being fired in a closed vessel of equal internal length and diam. and of 28·18 cub. in. capacity, the pressure being estimated from the compression of a piece of copper, which was registered on a revolving drum by a pen carried by the compressing piston, and the time being registered on the same drum by a tuning-fork of frequency 500. The maximum pressure produced was found to be independent of the temperature of the cordite, but the rate of pressure-rise increases with the temperature, so that temperature is all-important in the investigation of time-rises. The relation $P = 360\Delta^3 - 54\Delta^2 + 69{\cdot}8\Delta$ between the pressure in tons' weight per sq. in. and the sp. gr. was found, its form showing that in discussion of the gas produced van der Waals' term a/v^2 must not be neglected. With cordite in the cord form the relation $S = aP + C$ was found, S being the skin burnt off in a given time under the average pressure P, C the constant 0·00028 and a having the value 0·001223 at 60° F. and 0·0018361 at 80° F. This differs in form from Vieille's by the term C, which is explained as due to the gas produced by combustion of the ends of the sticks. Cordite in tube form burns in more complicated fashion and somewhat like a "cracker," by reason of gas generated at the inner surface at a faster rate than it can get out and then explosively escaping, so that there seem to be two phases in its combustion, viz., when excess pressure exists within the tubes and when this excess disappears. A double tubular form of modified cordite was also examined. R. E. B.

1175. *Thermal Radiation at very Low Temperatures.* **J. T. Bottomley.** (Brit. Assoc., Report, pp. 330–332, 1905.)—The author has continued his experiments on the loss of energy from a heated body [Roy. Soc., Phil. Trans. A. 184. p. 591, 1893] using the same apparatus, namely, a copper globe 5 cm. diam., from which the radiation takes place, and a hollow sphere of copper, of diam. 10 cm., whose interior surface was coated with a thin covering of fine-grained lampblack, the inner globe being similarly coated, or else silvered electrolytically and polished to the highest degree attainable. The enclosing envelope is connected to mercury pumps, and the results given were obtained at pressures not greater than $\frac{1}{10}$ or $\frac{2}{10}$ of a millionth of an atmo. (called by the author 0·1 or 0·2 m.). The experiments here dealt with concern the radiation at lower temperatures obtained by means of liquid air and liquid hydrogen. The results for the sooted globe show that for abs. temperatures from 246·4° down to 182·5°, corresponding to excess temperatures of cooling globe above surroundings of 165·4° down to 51·5°, the emissivity, or loss of heat per cm.^{2}/sec. per 1° C. of excess temperature, ranges from $9{\cdot}57 \times 10^{-5}$ down to $5{\cdot}64 \times 10^{-5}$. For the silvered globe, for abs. temperatures 290·0° down to 260·0° and excess temperatures 211·0° to 181·0° the emissivity ranges from $4{\cdot}502 \times 10^{-6}$ down to $4{\cdot}01 \times 10^{-6}$. L. H. W.

1176. *Isothermals of Hydrogen between —104° and —217° C.* **H. Kamerlingh Onnes** and **C. Braak.** (Konink. Akad. Wetensch. Amsterdam, Versl. 15. pp. 517–539, Jan. 11, 1907. Proc., 9. pp. 754–775, April 25, 1907. Communication No. 97*a* from the Phys. Lab., Leiden.)—This is an account of the apparatus, its arrangement, the methods of measurement and calculation, and the constants assumed, details on each part of which have been the subject of previous communications. The isothermals for the temperatures —103·57°, —135·71°, —182·81°, —195·27°, —204·70°, —212·82°, —217·41° C. on the hydrogen constant-volume thermometer with 1·1 m. pressure at 0° C. have been determined, the points found for each being but few, but determined with particular care so as to insure their being actually *on*, and not merely *near*, the isothermal. For these temperatures the constants of the formula, $pv = \mathrm{A} + \mathrm{B}v^{-1} + \mathrm{C}v^{-2} + \mathrm{D}v^{-4} + \mathrm{E}v^{-6}$, have been calculated [with pressures expressed in atmos. of apparently 75·9429 cm.], and they seem to vary regularly with the temperature. The minimum values of pv seem to lie on the parabola, $p = -2{\cdot}623 + 552{\cdot}610\,(pv) - 1354{\cdot}86\,(pv)^2$, so that the highest pressure at which a minimum occurs is 53·78 atmos., which corresponds to a temperature 68·5° abs. R. E. B.

1177. *Measurement of very Low Temperatures.* XIV. *Reduction of Constant-volume Hydrogen Thermometer Readings to the Absolute Scale.* XV. *Influence of Deviations from the Gaseous Laws on Estimations of Temperature by Constant-volume Gas Thermometers.* **H. Kamerlingh Onnes** and **C. Braak.** (Konink. Akad. Wetensch. Amsterdam, Versl. 15. pp. 668–677, Feb. 6, 1907. Proc., 9. pp. 775–785, April 25, 1907. Communication No. 97*b* from the Phys. Lab., Leiden.)—The characteristic for hydrogen on the absolute scale of temperature being taken of the form—

$$pv = 0{\cdot}0036618\ \mathrm{T}(1 + \beta/v),$$

the value of β is determined in the form $a\mathrm{T} - b - c\mathrm{T}^{-1} + d\mathrm{T}^{-3} - e\mathrm{T}^{-5}$, as in a former paper, and the values of $\Delta t \equiv \mathrm{T} - t - 273{\cdot}09$ for the standard temperatures t on the constant-volume scale used in the preceding paper, each of which should be taken 0·01 higher, are found to be 0·0214, 0·0316, 0·0580, 0·0611, 0·0683, 0·0752, 0·0796 respectively. A formula is then given for deriving absolute temperature from that on the constant-volume scale, the error introduced by neglecting variations of density in the dead space, &c., of the thermometer being found to be too slight with hydrogen to be taken into account. R. E. B.

ELECTRICITY AND MAGNETISM.

DISCHARGE AND OSCILLATIONS.

1178. *Ionic Velocities in Helium.* **J. Franck** and **R. Pohl.** (Deutsch. Phys. Gesell., Verh. 9. 9. pp. 194–199, May 15, 1907. Phys. Inst. d. Univ., Berlin, March, 1907.)—As promised [Abstract No. 868 (1907)] the authors have now extended their method to measure the velocities of ions produced by α-rays in helium. Their results are 5·09 cm. per sec. for positive, and 6·31 cm. per sec. for negative ions, *i.e.*, faster than for all gases except hydrogen. R. S. W.

1179. *Current carried by Canal Rays.* **C. C. Perry.** (Phys. Rev. 24. pp. 447–448, May, 1907. Abstract of paper read before the Amer. Phys. Soc., March 2, 1907.)—The rays penetrate into a Faraday cylinder, which is connected to earth through a galvanometer. The current carried by the rays is thus measured and compared with the total current going through the tube. It is found that the rays carry the maximum current at pressures higher than those usually accepted, 0·035–0·04 mm. The latter are, however, the pressures at which the fluorescent effects are a maximum. The pressure at which the maximum number of rays are present is connected in some way with the beginning of kathode rays in the discharge, and also varies with the gas in the tube. R. S. W.

1180. *Anode Rays.* **E. Gehrcke** and **O. Reichenheim.** (Deutsch. Phys. Gesell., Verh. 9. 9. pp. 200–204, May 15, 1907. Communication from the Physikal.-Techn. Reichsanstalt.)—A continuation of the work described in Abstracts Nos. 96 and 869 (1907). The rays are quite analogous to kathode rays. They carry a positive charge, cast shadows, are emitted perpendicularly to the surface of the anode, cause fluorescence, and may be deflected by electric and magnetic fields. A determination of e/m is in progress.

R. S. W.

1181. *Discharge Potentials.* **Tits.** (Annal. Soc. Sci. de Bruxelles, 31. 2. pp. 144–205, 1906–1907.)—Six Leyden jars, charged by a Wimshurst machine, are connected to one end of a spark-gap, the far end of which is earthed. The potential used is measured on an electrometer of special design, in principle like an absolute electrometer. The spark-gap poles are a plane and a sphere; their distance apart can be varied and the medium surrounding can be exhausted or charged with any gas. A great number of curves are given showing the spark potentials for many homologous series, *e.g.*: (1) C_4H_9OH, C_3H_7OH, C_2H_5OH, CH_3OH, HOH. (2) CH_4, CH_3Cl, CH_2Cl_2, $CHCl_3$, CCl_4. (3) Same series for bromides. (4) Same series for iodides. (5) CCl_4, CS_2, CO_2, CH_4. (6) NH_3, $NH_2C_2H_5$, $NH(C_2H_5)_2$, $N(C_2H_5)_3$. In all cases the relation of pressure to spark-potential is shown to be definitely connected with these changes in composition. In general the heavier or more complex molecules show less sparking tendency than the simpler.

P. E. S.

1182. *Temperature Measurements in the Mercury Arc.* **R. Küch** and **T. Retschinsky.** (Ann. d. Physik, 22. 3. pp. 595–602, March 5, 1907. Communication from the Laboratory of W. C. Heraeus. Écl. Électr. 51. pp. 213–215, May 11, 1907.)—Investigations were made, in continuation of those previously described [Abstract No. 1607 (1906)], of the behaviour of the mercury arc in quartz lamps. Measurements of temperature were obtained by means of a Pt and Pt-Rh thermo-element, and simultaneous readings were taken of the voltage and current-strength. The temperature was observed up to about 1,700°—the melting-point of platinum being 1,710° according to Holborn and Henning. With increasing current and constant voltage the mean temperature of the source of light increases. As it was incidentally established that the vapour pressure remains constant when the e.m.f. remains the same and the current increases, and increases with a steady current and rising voltage, it follows that the mean temperature of the arc, while the pressure remains the same, rises with increasing current. With a steady current of 4 amps. the e.m.f. was raised from 30 to 107 volts by successive steps and the temperature-change observed. Three junctions were used in the tube, one situated in the axis and the others above and below. A fall of temperature from the inside to the outside of the arc was indicated. The curves showing the rise of temperature are different for the three elements: that for the junction in the middle is a straight line, indicating a rise of temperature proportional directly to the increasing voltage. The increase of temperature becomes less and less rapid after a certain value of the e.m.f., as shown by the under and upper elements, indicating that with increasing voltage they find themselves more and more in the periphery of the arc. The middle thermo-element indicates a temperature of 1,700° with voltage 60. The authors believe they have established that the mean temperature in the lamp increases from relatively low to very high values, and they see in this a confirmation of their view that with high loads heat radiation plays a part in the phenomena. [See also Abstract No. 1074 (1907).] J. J. S.

1183. *Selective Absorption in Mercury Arc Lamps.* **R. Küch** and **T. Retschinsky.** (Ann. d. Physik, 22. 5. pp. 852–866, May 2, 1907. Communication from the Laboratory of W. C. Heraeus. Écl. Électr. 51. pp. 356–358, June 8, 1907.)—Layers of different thickness of the mercury arc lamp show differing distribution of intensity for the same temperature in the line spectrum. In the spectrum of the thicker layer the weaker of the neighbouring lines are relatively stronger. This is due to absorption in the arc, so that, of lines near together, the line of greater emission will also be more strongly absorbed. Observations were made by means of two lamps placed one in front of the other, and the percentage absorption of the light from the first falling on the second was measured in the case of certain definite lines of the spectrum. The phenomena agree with Kirchhoff's rule. Moreover, with equal absorbing action of the layers, the spectra of layers of differing temperature behave differently; with high temperature the lines of smaller wave-length are relatively stronger than with lower temperature. In the case of the ultra-violet spectrum especially it was found that the lines of smaller wave-length were less absorbed than those of greater wave-length. [See also Abstract No. 1607 (1906) and preceding Abstract.] J. J. S.

1184. ***Electromagnetic Waves on a Wire with a Cylindrical Insulating Covering.*** **F. Harms.** (Ann. d. Physik, 23. 1. pp. 44–60, May 28, 1907. Phys.

Inst., Würzburg, March 4, 1907.)—The author has obtained the following results mathematically, and a note appended to the paper by the reviser indicates that they have been confirmed by experiments carried out in the Institute. Electromagnetic waves on wires of high conductivity surrounded by cylindrical insulating coverings are propagated with a velocity which is less than the velocity of light. The decrease of speed is greater in proportion to the dielectric constant, to the thickness of the covering, and to the period of the wave, and is inversely proportional to the radius of the wire. If the conductivity of the wire be assumed to be infinite it is easy to calculate the reduction of the velocity of propagation due to any given covering. The numerical examples given below illustrate the actual change in some typical cases. A high-tension cable with a copper conductor 1 mm. thick, and guttapercha insulation 2 mm. thick, carries a current whose wave-length in air is 244 cm. The actual wave-length on the wire will be 234 cm.—a decrease of about 4 per cent. If a covering of higher inductivity be taken, such, for instance, as water, the decrease may be much greater. Thus for the same wire a water covering 0·5 cm. thick would reduce the wave-length to 77 per cent., a covering of 1 cm. to 54 per cent., and a covering of 2 cm. to 14 per cent. of the wave-length in air. An infinitely thick mass of water would reduce the length to 11 per cent. of that in air. [See also Slaby, Abstract No. 1702B (1905).] J. E.-M.

ELECTRICAL PROPERTIES AND INSTRUMENTS.

1185. *Geometrical Mean Distances of Rectangular Areas and the Calculation of Self-inductance.* **E. B. Rosa.** (Bureau of Standards, Bull. 3. pp. 1–41, April, 1907.)—The author first gives Weinstein's and Stefan's formulæ for the self-inductance of a circular coil of wire of rectangular section. The method of calculating the correction for the self-inductance of insulated round wire is next considered, and Maxwell's correction, which has been re-computed by Chree, is adopted. Maxwell stated that the geometrical mean distance of two squares side by side is 0·99401 times the distance between their centres. The author, by calculating on the lines laid down by A. Gray (*vide* "Absolute Measurements," vol. ii., part i., p. 288), finds that the number should be 1·0065498. He next calculates the geometric mean distance of other squares in the same row or column, and then finds the correction for the second row, and hence for the first two layers of wire. He also gives the correction for three layers and five layers of wire, and the correction terms for each of the squares in a large square made up of 11 × 11 unit squares. The geometric mean distance between two squares placed corner to corner is found to be 0·997701 times the distance between their centres. It is shown that Weinstein's, Stefan's, and Maxwell's formulæ for the self-inductance of a circular coil of square section give practically the same results to seven figures when the mean radius is 25 cm. and the dimensions of the section are 0·1 × 0·1 cm. If, however, the dimensions of the section are 1 × 1 cm., Maxwell's formula gives a result which is less than that given by either of the others by 1 part in 60,000. Numerical examples are worked out for the self-inductances of coils of two, four, ten, sixteen, and twenty turns. Lastly, the correction for curvature is considered, and the results found show that this correction is very important in special cases. In the Appendices, tables of inverse tangents to nine decimal places of the constants required in Stefan's equation and of the Napierian logarithms of all numbers from 1 to 100 to nine decimal places are given. A. R.

1186. *Electrical Conductivity of Alloys.* II. *Constitution and Temperature-Coefficient.* **W. Guertler.** (Zeitschr. Anorg. Chem. 54. 1. pp. 58–88, May 28, 1907. Communication from the Inst. f. anorg. Chemie d. Univ., Göttingen.)—The course of the author's reasoning from published data does not permit of brief abstraction, but some of the conclusions follow. With few exceptions there is a proportionality between the electrical conductivity of alloys of two components and the corresponding temperature-coefficients. In all cases the form of the curve of temperature-coefficients corresponds to that of the curve of conductivities. The exact measurement of resistance of a piece of metal as a test of composition, soundness, or homogeneity is not always essential if a comparative method be available. The use of the temperature-coefficient is suggested. Two measurements of resistance of the mass of metal are made at, say, 0° and 100°; the temperature-coefficient is $(R_{100} - R_0)/R_{100}$. From the values of this, and the known properties of the alloy, the condition of the sample may be judged. Although the resistances of the components of mixed crystals be zero at the absolute zero of temperature, yet the resistance of the mixed crystals, always independent of the resistances of its components, may still be very considerable. [See also Abstract No. 804 (1907).] F. R.

1187. *Change of Conductivity and Density of Lead by Stretching.* **J. A. Donaldson** and **R. Wilson.** (Roy. Soc. Edinburgh, Proc. 27. pp. 16–20, 1906–1907.)—The authors' experiments show that if there be any change of specific resistance of lead wires when stretched up to 17·5 per cent. of the length, it cannot exceed ±0·017 per cent. per 1 per cent. extension of the wire. Within the same limit of stretching, the increase of volume per 1 per cent. increase of length is not greater than ±0·012 per cent. As Gray and Henderson found a 0·22 per cent. decrease in density per 1 per cent. elongation, it appears probable that the change in density occurs for the greater part at or near the rupture. F. R.

1188. *Dielectric Constant of Water and Ice.* **F. Beaulard.** (Comptes Rendus, 144. pp. 904–906, April 29, 1907. Electrician, 59. p. 393, June 21, 1907. Translation.)—Measurements were carried out by the previous method [Abstract No. 1445 (1906)] for ice, water, and a mixture of both. The water was enclosed in an ellipsoidal vessel of thin glass. The dielectric constant was found to be 1·455 for ice on the point of melting, and 3·072 for water on the point of freezing. The dielectric constant of ice is of the order of magnitude of the square of the refractive index (1·71). The unusually low value of K for water may be attributed to the slight solubility of glass at the low temperature. E. E. F.

1189. *Transport of Ions in a Wehnelt Interrupter.* **J. Rodet.** (Électricien, 33. pp. 215–216, April 6, 1907.)—In a Wehnelt interrupter with test-tube perforated with an aperture of 1 mm., in circuit with the primary of an induction coil, under a current of 110 volts and 2 amps., the anode being in the test-tube but not consisting of a copper sheet like the kathode, but of a spiral of copper wire, the sparking in the secondary coil was continuous; but it was found that the spiral wire anode was rapidly eaten away and a layer of copper was deposited on the inner wall of the test-tube. A. D.

1190. *A Speaking Condenser.* **T. Argyropoulos.** (Comptes Rendus, 144. pp. 971–972, May 6, 1907.)—The well-known singing condenser has been found to be able to reproduce speech by the author's simple expedient of applying to the condenser terminals in the secondary circuit a direct-current e.m.f. of 220 volts. The microphone circuit included the transformer primary, of 2·5 mm. diam. wire 70 m. long. The secondary was a similar winding, and the thin sheet-iron core was 3 to 4 cm. in diam. The microphone, transformer and condenser were each placed in separate rooms to make certain that it was the condenser which was speaking. With 110 volts words were still distinctly reproduced, but much more feebly. **M. Deprez.** (Ibid. pp. 1012–1014, May 13, 1907.)—Deprez shows that the addition of the auxiliary e.m.f. enables the effect to be increased to almost any extent, and that the increased attraction of the condenser leaves across the dielectric is, for a small current increase, practically proportional to the auxiliary e.m.f. E. For, if ΔE represent the increment of e.m.f. caused by the microphone, the attractive force F experiences an increase which, neglecting the square of ΔE, is given by $\Delta F = 2F_1E \, . \, \Delta E$, where F_1 is the attractive force when E is unity. When $E = 0$ (as in the ordinary singing condenser), the attractive force ΔF becomes $\Delta F' = F_1(\Delta E)^2$, hence the ratio of the acoustic amplitudes or intensities for the speaking and the singing condenser is $2E/\Delta E$. **P. Sève.** (Ibid. pp. 1211–1212, June 3, 1907.)—Sève gives reasons why reproduction of speech can only be obtained when a considerable auxiliary e.m.f. is applied to the condenser. Since the stresses on the condenser leaves are proportional to the p.d., the sounds emitted by a condenser into which a telephone current is sent are considerably altered. If the e.m.f. is of the form $e = a \sin \omega t$, the attractions which are proportional to $\sin^2 \omega t$ or to $1 - \cos 2\omega t$, will make the condenser emit sounds that are an octave higher. In the case of musical sounds this makes little difference, but speech becomes unrecognisable. The arrangement of Argyropoulos (auxiliary e.m.f.) enables one, as Deprez has shown, to produce variations in the attraction which are proportional to the e.m.f. and are of much greater amplitude. In conjunction with Villard, Sève has repeated Argyropoulos' experiment. On connecting the condenser to the alternating-current mains (42-∿) or an alternator of frequency 500 per sec. the sounds corresponding to 84 and 1,000 were heard, while on adding an auxiliary e.m.f. (of 270 volts continuous) the fundamental tones 42 and 500 were heard, and these were much louder. This experiment thus bears out Sève's explanation. L. H. W.

1191. *Sensibility of the Electrostatic Telephone.* **H. Abraham.** (Comptes Rendus, 144. p. 1154, May 27, 1907.)—The author's telephone receiver consists of a piece of aluminium-foil supported on a sheet of gauze, and placed over the opening of a small ear-piece. An insulated metal disc is brought up as close as possible to the metallic leaf, thus constituting a condenser, the whole being enclosed in a receiver case. The apparatus being charged by as high as possible a static voltage (1,000 volts), the alternating p.d.'s are applied and the vibrations of the diaphragm noted. With a frequency of 500 per sec. the smallest alternating voltage which will give an audible sound is 8 millivolts. In order to employ the device as a telephonic receiver the alternating voltage could be transformed up or resonance effects be made use of. But even when amplified in this way the sensitiveness is still far below that of the electromagnetic telephone for the transmission of speech by means of telephonic lines. L. H. W.

1192. *New Quadrant Electrometer.* **H. Schultze.** (Zeitschr. Instrumentenk. 27. pp. 65–75, March, 1907. Communication from the Physikal.-Techn.

Reichsanstalt.)—This is a very complete description of a carefully constructed quadrant electrometer, in which many of the difficulties attending the usual type have been abolished. The "Theory and Practice of the Quadrant Electrometer," by Orlich [see Abstract No. 159 (1904)] is frequently referred to, and this, together with the present paper, should be consulted by those interested in the subject as the detailed description of the erection and uses of the instrument is unsuited for a short abstract. F. E. S.

1193. *Electromagnetic Compass.* (Brit. Pat. 4,609 of 1907. Engineer, 103. p. 538, May 24, 1907. Abstract.)—A description of an apparatus patented by L. D. J. A. Dunoyer for determining the true angular divergence from the magnetic meridian, more particularly for use at sea. The apparatus comprises an earth-inductor whose frame is mounted on a vertical spindle, which is rotated by any suitable means. The spindle is attached rigidly to the ship or is suspended by means of a universal joint, according to the degree of accuracy desired in the readings. The ends of the wire are connected up to a two-part commutator on the spindle. Two pairs of brushes rub on the commutator, one pair being fixed at the ends of a diameter of the commutator at right angles to the length of the ship, and the other pair at the end of a diameter parallel to the length. These two pairs are indispensable, but if greater accuracy is required other pairs of brushes may be used at the ends of intermediate diameters. Each of the pairs of brushes is connected to two terminals of a multipolar switch, which will allow of disestablishing connection separately between each pair of brushes and the two terminals of a movable frame astatic galvanometer. The amount of the galvanometric deflection will indicate the divergence of the ship's longitudinal axis from the meridian. A. W.

1194. *Improved Vibratory Interrupter.* **O. Canter.** (Elektrotechn. Zeitschr. 28. p. 534, May 23, 1907. Elektrotechnik u. Maschinenbau, 25. pp. 450 and 451, June 9, 1907.)—A centrally pivoted armature is placed in front of and on the same side of two electromagnets, one at each end. One electromagnet has two equal but oppositely-wound windings. On current being switched on, one of these windings is permanently excited and that armature end attracted, thus closing a contact. By means of this contact the other electromagnet and the second winding of the first electromagnet (which are in series) are excited, thus demagnetising the first electromagnet and allowing the other end of the armature to be attracted, thereby opening the contact, when the process repeats itself. The arrangement is due to Ammon, and is made by Siemens and Halske (D.R.-P. 177,677). A similar arrangement due to Müller is described in the second article. In this case a similar armature is used and the two electromagnets are in series at the commencement. Since one winding is made to produce a stronger effect than the other, the armature end is attracted by that electromagnet and thereby closes a contact which short-circuits the stronger winding, upon which the weaker electromagnet becomes operative (D.R.-P. 174,951). L. H. W.

1195. *Moto-magnetic Mercury Interrupter.* **L. Drault.** (Archives d'Él. Médicale, 15. pp. 376-380, May 25, 1907.)—The interrupter is of the mercury turbine type, but has several new features. No separate motor is required for driving the turbine, which is driven by means of two oblique-approach members attached to the turbine shaft; the attraction of the core of the coil itself is made use of to impart the motion to the oblique-approach members. Further, to obviate the churning-up of the mercury, converting it into a form of emulsion, the rupture takes place in an atmosphere of acetylene or coal-gas. By this means the quantity of mercury required is much reduced (to 400 gm. about). Illustrations are given of the parts of the apparatus, which is due to Béclère. L. H. W.

ALTERNATING CURRENTS AND MAGNETISM.

1196. *Heusler's Magnetic Alloy.* **A. D. Ross.** (Roy. Soc. Edinburgh, Proc. 27. pp. 88–92, 1906–1907.)—Describes magnetic measurements made on samples of an alloy containing 25 per cent. Mn, 12·5 per cent. Al, and a trace of Pb, the remainder being Cu. The alloy was tested in the form of cast rods, by the magnetometric method, the rods being ground on emery to an ellipsoidal shape. The specimens of the alloy were subjected to thermal treatment, being heated for various periods of time to temperatures ranging from 50° up to 750° C.; specimens both slowly cooled and also quenched from these temperatures were examined; the specimens were also measured while immersed in liquid air. Hysteresis and permeability curves are given showing the effects of this treatment. Baking for three days at 160° produced a distinct improvement in magnetic quality, but heating to higher temperatures produced a steady deterioration. It was found, however, that the time effect of heating was very large, and this has still to be investigated. Immersion in liquid air produced an increase of 25 per cent. in the saturation value of I; on re-testing the same specimen after warming up to the temperature of the room, the improvement was found to have been only temporary. As regards the effects of quenching, there is a marked decrease of permeability produced by quenching at 600° C., but quenching at higher temperatures restores the quality to a considerable extent. The peculiar behaviour of the alloy at 600° is ascribed by the author to structural changes within the metal. W. Ros.

ELECTRO-PHYSIOLOGY AND ELECTRO-THERAPEUTICS.

1197. *New Stereoscope Applicable for Radiographs.* **De M. Pigeon.** (Archives d'Él. Médicale, 15. pp. 295–297, April 25, 1907.)—The stereoscope consists of two rectangular panels fixed together so as to form an obtuse angle. This angle is bisected by a frame supporting a triangular mirror, which faces the left-hand panel. The left-hand photograph is printed in the reverse sense. In using the apparatus the observer places his left eye close to the mirror, so that his right sees the right-hand photograph and the left eye the reflected image of the left-hand photograph. The latter being reversed is again reversed by the mirror, and the two images become fused stereoscopically. H. W. P. Y.

1198. *Intensity Meter for Röntgen Rays. An Opaque Material.* (Elektrotechnik u. Maschinenbau, 25. p. 452, June 9, 1907.)—A cell by means of which the intensity of the rays can be gauged has been devised by G. Schwarz (Austrian Pat. 27,167). The cell is filled with an ammonium oxalate sublimate mixture, which, after exposure to Röntgen rays, gives a white precipitate. The degree of turbidity or the weight of the precipitate can be determined, and from this the intensity of the radiation deduced; or by centrifugalising the mixture and measurement of the depth of the precipitate. A material which is said to be wholly impenetrable for the Röntgen rays is disclosed by W. Meisel (D.R.-P. 179,502). Finely-powdered metal or metallic oxide is moistened with a rubber solution, stirred to a paste, rolled out and vulcanised. Before vulcanisation the material can be covered with unvulcanised rubber and then vulcanised together. Finally, the material can be sandwiched between suitable textile materials, to which it is cemented. L. H. W.

REFERENCES.

1199. *The Electron as a Centre of Pressure.* **M. Wolfke.** (Écl. Électr. 51. pp. 73–81, April 20, 1907.)—Considers the "positive electron" as a centre of outward pressure in an elastic ether, with a constant flux, and the negative electron as a centre of inward pressure. Hence deduces the inverse-square law. E. E. F.

1200. *Electrons.* **H. Becquerel.** (Soc. Int. Élect., Bull. 7. pp. 291–306, May, 1907.)—An excellent *résumé* of recent work and theory in the domains of kathode rays, canal rays, radio-activity, and magneto-optical phenomena. E. H. B.

1201. *Dimensions of Electric and Magnetic Quantities.* **L. G. Muaux.** (Assoc. Ing. Él. Liége, Bull. 6. pp. 330–378, Aug.–Sept.–Oct., 1906.)—An amplified account of the system outlined in Abstract No. 340 (1906).

1202. *Point-discharge Particles.* **J. Franck.** (Ann. d. Physik, 21. 5. pp. 972–1000, Dec. 14, 1906.)—The full paper corresponding to Abstract No. 1760 (1906).

1203. *Reflection and Transmission of Electric Waves by Resonator Gratings.* **C. Schaefer.** (Phys. Rev. 24. pp. 421–427, May, 1907.)—This paper is a criticism of one with the same title by F. C. Blake and C. R. Fountain [Abstract No. 100 (1907)], and refers to similar work by Garbasso, Aschkinass, and the present author [Abstracts Nos. 1925 (1901) and 803 (1905)]. It is concluded that the objective reality of the phenomenon of "extra transmission" of certain resonator gratings on glass (over that of the glass plate alone) is not yet established. [See also Abstract No. 119 (1907).] E. H. B.

1204. *Magnetic* v. *Mechanical Production of Undamped Oscillations.* **H. F. v. Traubenberg.** (Elektrotechn. Zeitschr. 28. p. 559, May 30, 1907.)—Referring to Mosler's paper [Abstract No. 464 (1907)], the author points out that the magnetic and mechanical methods are essentially different. The distinguishing feature of the magnetic method is its capability of supplying a power component of the alternating current, or of increasing the power component which is already present in the arc. The efficiency of the transformation is thereby greatly increased. A. H.

1205. *Ionisation of Gases.* **A. Gallarotti.** (Accad. Lincei, Atti, 16. pp. 297–304, March 3, 1907.)—Perrin concluded that the ionisation of a gas by Röntgen rays is proportional to the absolute temperature: McClung [Abstract No. 1124 (1904)] that it in no way depends upon the temperature. The author confirms McClung's results, and extends them to the case in which ionisation is produced by radium. A. D.

1206. *Theory and Design of Induction Coils.* **E. W. Ehnert.** (Elektrotechnik u. Maschinenbau, 25. pp. 337–342, May 5; 361–365, May 12; and pp. 377–381, May 19, 1907.)—These articles contain a simplified account of the theory of the induction coil, a number of tables of data useful in the design of induction coils, various practical details concerning them, and directions for their construction. A. H.

1207. *A Constant Exciter of Electric Oscillations.* **M. Laugwitz.** (Phys. Zeitschr. 8. pp. 378–379, June 1, 1907.)—For oscillations of wave-length 6–80 cm.

1208. *Behaviour of Bismuth in a Magnetic Field.* **U. Crudeli.** (Atti dell' Assoc. Elettr. Ital. 11. pp. 68–88, Jan.–Feb., 1907.)—Investigates the influence of impurities, and gives revised tables for the resistance in various magnetic fields, with a special view towards utilising bismuth for telephone repeaters. E. E. F.

1209. *Potential and Mutual Action of given Magnets.* **A. Schmidt.** (Preuss. Akad. Wiss. Berlin, Sitz. Ber. 16. pp. 306–322, 1907.)—An elaborate mathematical paper on the general expression for the potential of two magnets as used in the deflection experiment for determining the earth's horizontal intensity. E. H. B.

1210. *Magnetic Field and Inductance Coefficients of Circular, Cylindrical, and Helical Currents.* **A. Russell.** (Phil. Mag. 13. pp. 420–446, April, 1907. Paper read before the Physical Soc., Feb. 8, 1907.)—A highly analytical paper in which by Laplace's law and elliptic integrals the above problems are solved. Those interested in the subjects of this valuable paper should consult the original, which is unsuited for detailed abstraction. E. H. B.

1211. *Spark Discharge.* **A. Battelli** and **L. Magri.** (Accad. Lincei, Atti, 16. pp. 155–158, Feb. 3, 1907. N. Cimento, 13. pp. 263–268, April, 1907.)—Reproduces some photographs of spark discharges with and without revolving mirror or magnetic field. E. E. F.

1212. *Interference Experiments with Hertzian Waves.* **F. Kiebitz.** (Ann. d. Physik, 22. 5. pp. 943–972, May 2, 1907.)—Further detailed experiments with very short waves (wave-length 80–130 cm.) [see Abstract No. 104 (1907)]. The radiation from a sextuple-antenna system is also examined, but as the author's "great distances" were within the confines of a room, and the detector was a coherer, the results can hardly be taken as measuring the direct radiation. L. H. W.

1213. *Use of Platinocyanide Pastilles in Radio-therapy.* **J. Rouch.** (Archives d'Él. Médicale, 14. pp. 792–795, Oct. 25, 1906.)—The author gives experimental results which tend to show that it is important, in working with such chromometric indicators, to operate in semi-obscurity and to avoid frequent exposure of the pastilles to the full daylight during the treatment. L. H. W.

1214. *Theory of Coherers.* **P. Jégou.** (Écl. Électr. 51. pp. 82–84, April 20, 1907.)—Reduces the cohering action to a simple increase of pressure due to the electric or magnetic forces between the grains. The more closely the actual pressure approaches the critical pressure of coherence the more sensitive is the coherer. E. E. F.

1215. *A Self-acting Vacuum Scale.* **W. B. v. Czudnochowski.** (Deutsch. Phys. Gesell., Verh. 9. 7. pp. 136–144, April 15, 1907.)—A description of the theory and method of construction of a "self-acting" vacuum scale for use in various experiments requiring the discharge in vacuum tubes with gases at different pressures. J. J. S.

1216. *The Percentage Bridge.* **A. C. Longden.** (Phys. Rev. 24. pp. 349–355, April, 1907.)—The author states the claims of the bridge described by H. C. Parker [Abstract No. 2244 (1900)] to superiority over that of Carey-Foster in regard to difference in the end-resistances being negligible, sensitiveness and range. He then proceeds to show that the property of the percentage bridge as stated above is not strictly true for all positions of the balancing point, but that this fault may be eliminated by the use of a single set of auxiliary coils correct for the middle point on the wire, applying a suitable scale of corrections for other points. G. E. A.

CHEMICAL PHYSICS AND ELECTRO-CHEMISTRY.

1217. *Melting-point of Litharge.* **F. O. Doeltz** and **W. Mostowitsch.** (Metallurgie, 4. pp. 289–290, May 22, 1907. Communication from the Metallhüttenmänn. Laborat. d. Kgl. Techn. Hochschule, Berlin.)—The author gives 906° for the melting-point of lead oxide, from the mean of observations taken by a thermo-couple and by a Wanner pyrometer. The powder cohered, forming a lump which could be lifted by means of the thermo-couple wires at 850°. This is due to the occurrence of sublimation; the same property is shown by zinc oxide, cadmium oxide, and lead sulphide. [See Abstract No. 1925 (1906).] F. R.

1218. *Velocity of Combination of Hydrogen and Oxygen.* **A. W. Rowe.** (Zeitschr. Phys. Chem. 59. pp. 41–71, April 28, 1907. Inst. f. physikal. Chemie, Göttingen, 1906.)—The author has studied the velocity of combination of hydrogen and oxygen in porcelain tubes, when the gases are diluted with water vapour. It was found that at lower temperatures the catalytic action predominated over the chemical, so that the velocity tended to become that of a diffusion process according to Nernst. As the temperature is raised, however, the chemical reaction begins to predominate, and the reaction, therefore, tends to become one of the third order. A. F.

1219. *Molecular Attraction.* VI. *Mutual Neutralisation of the Attraction by the Attracted Particles; Nature of Attractive Forces.* **J. E. Mills.** (Journ. Phys. Chem. 11. pp. 132–166, Feb., 1907.)—The author gives a more rigorous deduction of the equation, $(L - E)/(\sqrt[3]{d} - \sqrt[3]{D}) = \text{constant}$ [see Abstract No. 2062 (1902)], and summarises the experimental evidence supporting it. The equation deduced by Helmholtz in 1854 to represent the energy given out by the contraction of the sun will, by changing the constant, represent accurately the energy given out by isopentane and other substances in changing from a saturated vapour to a liquid. It is shown that hydrogen and oxygen at the absolute zero of temperature possess large amounts of chemical energy, one-half of which is probably kinetic and the other potential; chemical attraction is probably unaffected by temperature. The idea is introduced that the attractive forces, whether chemical, molecular, magnetic, electrical, or gravitational, which proceed from a particle are definite in amount. If this attraction is exerted upon another particle, the amount of the attraction remaining to be exerted upon other particles is diminished by an exactly equivalent amount. It follows that the various attractive forces are measured by the amounts of the attraction neutralised, and that the idea that the gravitational attraction of a particle could remain undiminished regardless of the amount of the attraction exerted upon other particles is contrary to the law of the conservation of energy. [See also Abstract No. 1326 (1906).] T. H. P.

1220. *The Atomic Weights, a Function of the Position they occupy in the Series of their increasing magnitude.* **A. Minet.** (Comptes Rendus, 144. pp. 428–430, Feb. 25, 1907.)—By assigning to the elements arranged according to their atomic weights the numbers 1–79, and plotting the assigned numbers as abscissæ against the atomic weights as ordinates, two curves are obtained, viz., (1) a straight line expressed (within about 8 per cent. of the atomic weight) by $\gamma = 1\cdot985x$, comprising the elements numbered 2–20 (helium to calcium), and (2) a parabola represented by $\gamma = x^{1\cdot33}$ comprising the elements hydrogen and those numbered 20–79 (calcium to uranium); γ is the atomic weight and x the position in the series. By the addition of six new elements to the series the relation (for all the elements) between the atomic weights and the order in the series may be expressed by the single curve $x = x^{1\cdot215}$.

D. H. J.

1221. *Physical Properties of Liquid and Solid Acetylene.* **D. McIntosh.** Journ. Phys. Chem. 11. pp. 806–817, April, 1907.)—The results of the author's measurements on liquid and solid acetylene are as follows: Melting-point, −81·5° (at 895 mm.); subliming-point, −83·6°; heats of vaporisation, $21\cdot3 \times 10^{10}$ ergs (liquid) and $23\cdot0 \times 10^{10}$ ergs (solid); heat of fusion, $1\cdot7 \times 10^{10}$ ergs (?); specific heat of liquid, $4\cdot4 \times 10^{17}$ ergs; density, 0·613 for liquid at −80° and 0·72 for solid; molecular volume, 48·1; atomic volume of divalent carbon, 20–23; critical temperature, 36·5°; critical pressure, 61·6 atmos.; critical volume, 88 c.cm.; values of a and b in van der Waals' equation, 0·0880 and 0·00230 respectively.

T. H. P.

1222. *Energy-changes occurring on diluting Zinc and Cadmium Amalgams.* **T. W. Richards** and **G. S. Forbes.** (Zeitschr. Phys. Chem. 58. pp. 683–752, April 9, 1907. Translation.)—The authors give the results of measurements, to within 0·00001 volt, of the potentials of various zinc and cadmium amalgams. The potentials of the former are smaller, and those of the latter greater, than the values calculated from the gas laws; with increasing dilution, the deviations approximate more and more to zero. The temperature coefficient of the potential of the cadmium amalgam elements is almost identical with the pressure-temperature coefficient of an ideal gas, that of the zinc amalgam elements being about 3 per cent. greater. The heats of dilution of the amalgams, determined by a new calorimetric method, show, together with the temperature coefficients of the potentials, remarkably good agreement with Helmholtz's formula. Cady's formula [Abstract No. 727 (1899)], on the other hand, is not sufficient to explain the deviations from the gas laws, its failure being probably due to the method of evaluating the volumes employed in the calculation. The densities of the liquid Zn and Cd amalgams are given, together with the magnitudes of the contractions occurring on mixing the metals. The constitutions of the amalgams are explained from both the chemical and the kinetic standpoints. The deviations in the case of the Zn elements are attributed to partial polymerisation, and those of the Cd elements mainly to abnormal osmotic pressures. The question is too involved to allow of a complete quantitative treatment of these different influences without the aid of increased knowledge of osmotic pressure.

T. H. P.

1223. *Properties of Amalgams.* **P. Lebeau.** (Comptes Rendus, 144. pp. 843–845, April 22, 1907.)—The property of Pt amalgam, observed by Moissan [Abstract No. 1103 (1907)], of forming a voluminous emulsion with water, has been sought by the author in the case of other amalgams, and also using various liquids, but hitherto with negative results, except in the case of Ca and Li amalgams in benzene and in carbon tetrachloride.

Emulsions of the Pt amalgam were made in hot gelatine solution, and the structure fixed by chilling. The arrangement is similar to that of vegetable cells. F. R.

1224. *Effect of Cadmium on Rolled Brass.* **E. S. Sperry.** (Mech. Eng. 19. p. 746, May 25, 1907. From "The Brass World.")—The author's experiments show that the effect of Cd upon brass, in such proportions as are likely to be introduced by reason of the presence of Cd in commercial zinc, is practically nil. From 0·05 to 1 per cent. Cd was added to 60, 40 brass, which was then rolled. The ductility and rolling properties were not affected by the presence of the Cd, except that with 1 per cent. the metal was a trifle harder. The castings appeared to be the same with Cd as without. F. R.

1225. *Copper, Silver and Lead.* **K. Friedrich** and **A. Leroux.** (Metallurgie, 4. pp. 293–315, May 22, 1907. Communication from the Metallog. und Metallurg. Laborat. d. Kgl. Bergakad., Freiberg.)—Confirmatory results on the binary systems Cu-Ag and Cu-Pb are given. The solidification figure for the ternary system Cu-Ag-Pb consists of three surfaces, which meet in the ternary eutectic point: 0·5 per cent. Cu, 2·0 Ag, 97·5 Pb; the solidification temperature of this eutectic is about 0·5° to 1° C. below the eutectic temperature of the binary system Ag-Pb, *i.e.*, 300° C. On the Cu and Ag sides mixed crystals occur, but on the high-Pb side pure Pb separates, corresponding with the separation which occurs in the Pb-Cu alloys. Numerous curves and photomicrographs accompany the paper. F. R.

1226. *Copper-Tellurium Alloys.* **M. Chikashigé.** (Zeitschr. Anorg. Chem. 54. 1. pp. 50–57, May 28, 1907. Communication from the Inst. f. anorg. Chemie d. Univ., Göttingen.)—Gives the temperature-concentration diagram and microstructure of the Cu-Te alloys. The existence of Cu_4Te_3 and Cu_2Te is indicated. Cu_2Te forms at 855°, and undergoes two transformations, viz., at 387° and 351°. From about 50 to 100 per cent. Cu, the alloys consist of $Cu + Cu_2Te$. The eutectic of Te and Cu_4Te_3 solidifies at 344°. Cu_4Te_3 forms at 628°, and is transformed at 365°. The presence of as little as 0·01 per cent. Te in Cu may be detected by the microscope, as small specks of Cu_2Te readily show between the grains of Cu. Te cannot be removed by re-melting, even with the addition of Cu_2O. F. R.

1227. *Iron and Iron Sulphide.* **F. Rinne** and **H. E. Boeke.** (Zeitschr. Anorg. Chem. 53. 3. pp. 338–343, April 17, 1907. Communication from the Mineralog.-geolog. Inst. d. techn. Hochschule, Hannover. Metallurgie, 4. pp. 469–470, July 8, 1907.)—The authors show that the change-point in mixtures of iron and iron-sulphide is constant (138°) only with 7 per cent. Fe and upwards (*i.e.*, 93 per cent. or less of FeS). With less Fe the critical temperature becomes lower, and the change extends over an interval of about 10°. With 4 per cent. Fe the change is no longer observable above 20°. It is shown that the addition of carbon has the effect of reducing the change-temperature. [See also Abstracts Nos. 1093 (1903) and 1484 (1906).] F. R.

1228. *Boron Steels.* **L. Guillet.** (Comptes Rendus, 144. pp. 1049–1050, May 13, 1907.)—The author finds that boron steels consist of a solid solution of a small amount of boron in iron, pearlite, and a special body, apparently a boro-carbide of iron. When quenched from 850° this body dissolves in steels with low B content, and the brittleness which accompanies its separate presence disappears. The greatest effect upon the properties of low-carbon steels is obtained with about 0·8 per cent. B; *e.g.*, a steel containing, in percentages, C, 0·207; B, 0·844; Mn, 0·6; Si, 0·792, gave in the normal state a tensile strength of 50·1 kg. per mm.^{2}, with 14 per cent. elongation; when quenched from 850° the tensile strength was 175 kg. per mm.^{2}, and elongation 4 per cent. There was no difficulty in preparing the steels, ferro-boron being readily obtainable commercially as an electric furnace product. It is concluded that boron steels are worth attention for industrial purposes. F. R.

1229. *Evolution of Modern Tool-Steel.* **H. C. H. Carpenter.** (Engineering, 83. pp. 569–571, May 3, and pp. 633–634, May 17, 1907.)—The author discusses Taylor's paper [Abstract No. 369 (1907)]. He admits that micro-structure offers no criterion with regard to the degree of "red-hardness" possessed by a steel, high-speed steels when treated being usually characterised by an absence of well-defined structure. But it is emphasised that there are distinct evolutions of heat during the heating of high-speed steels through the range in which red-hardness is lost (650° to 730° C.). The effect of strain upon the tool is probably in the same direction as that of high temperature. It is suggested that at temperatures well above the zone in which red-hardness is lost, such as 900° to 950° C., the hardness of the high-speed steels may be so much greater than that of ordinary steels and iron at similar temperatures, that they may still be capable of cutting, and that future progress may be made in this direction. Chromium is considered to act by bringing about a more complete state of solution of the constituents of the steel. It is still open to question as to whether chromium hinders the critical changes similarly to tungsten or not. F. R.

1230. *Relation between Constitution and Ductility of Alloys.* **L. Guillet.** (Comptes Rendus, 144. pp. 1273–1275, June 10, 1907.)—Sums up the general laws connecting the constitution of alloys with their ductility or malleability. First case: The metals crystallise in the pure state; in their constitutional diagram, the liquidus is formed of two curves intersecting in a eutectic point, while the solidus is formed by a single horizontal line. In such alloys, if both constituent metals are malleable, all the alloys are malleable; if neither metal is malleable, the alloys also are brittle. If one metal is brittle and the other malleable, the malleability of the alloys depends principally upon that of the eutectic; if the eutectic point lies in that half of the diagram which lies on the side of the brittle metal, then the eutectic will be brittle, and *vice-versâ.* Alloys consisting of mixtures of pure metal and eutectic will have properties intermediate between both, but the presence of a small proportion of brittle constituent is sufficient to destroy the malleability of the alloy. Second case: Metals which are slightly soluble in one another in the solid state but do not form compounds. The liquidus is similar to that of case 1, but the solidus has a branch of a curve at both ends of the horizontal line. If one of these metals is malleable, the solid solution rich in this metal is always malleable; solid solutions rich in brittle metal have not been met with. With regard to other alloys of this class reasoning similar to that given above will apply. Third case: The metals form compounds or solid solutions that freeze at a constant temperature. The liquidus shows one or more maxima, while the solidus indicates the formation of solid solutions or compounds. All alloys containing pure compounds or solid solutions are brittle; if the diagram be then divided into separate systems by verticals passing through the maxima of the liquidus, each of these systems may be regarded as an example of case 1 or case 2 above, and the malleability of the alloys judged accordingly, bearing in mind the brittleness of all substances corresponding to maxima in the liquidus. In these cases only the alloys near the extreme ends of the series will be malleable. Fourth case: The alloys form compounds or solid solutions which, when pure, decompose before melting, the liquidus showing one or more transition points. These alloys may be regarded as coming under case 3, bearing in mind that the compounds or pure solid solutions indicated by the solidus are brittle. The fifth case, that of metals miscible in the solid state in all proportions, and the sixth case, that of alloys showing transformations in the solid state, are treated in the same manner and similar conclusions are arrived at. W. Ros.

1231. *Piping and Segregation in Steel Ingots.* **H. M. Howe.** (Amer. Inst. Mining Engineers, Bull. 14. pp. 169–274, March, 1907.)—Discusses in detail, with occasional experimental evidence, the causes of piping and segregation. Blow-holes, sagging, and the upward progress of freezing are usually effective in limiting the depth of pipe; practically it may be lessened by casting: in wide moulds, in sand moulds, preferably preheated; at top; slowly; with large end uppermost; with cooling of upper end retarded, *e.g.*, by sinking-head; by permitting deep-seated blow-holes to form through adjusting the quantities of Si and Mn or their equivalent; by liquid compression. The last six of these conditions will also tend to raise the position of the segregate. The degree of segregation will be lessened by addition of aluminium, casting small ingots, and further hastening cooling by casting at a "low" temperature; using thick-walled iron moulds; casting slowly. Rapid cooling tends, however, in some cases to increase segregation. Finally, it is admitted that only top-pouring can well be insisted on in the majority of cases, but in special cases the following might be specified: casting with large end up, with a sinking-head or its equivalent, and in ingots not larger than 8 in. square. The different systems of ingot compression are compared, and it is concluded that the best is that in which the ingot is laterally compressed at about the middle of its length, thus raising the segregate into the pipe, if the pressure be applied at the proper period in cooling. As regards tests and inspection, the purchaser may reasonably insist on inspection at the rolls and shears, and analysis of axial drillings of billets, &c., is especially desirable. F. R.

1232. *Durability of Lead Pans for Sulphuric Acid Concentration.* **W. B. Hart.** (Soc. Chem. Ind., Journ. 26. pp. 504–511; Discussion, p. 511, May 31, 1907. Paper read before the Manchester Section, April 5, 1907.)—The author discusses generally the physical condition and chemical composition of commercial lead with regard to their influence on its durability in use as pans for sulphuric acid concentration. Experimental results are given, including analyses of the metal of pans which have failed and the corresponding contents of pan. These alone usually indicate little, even when the metal is selected from the neighbourhood of the greatest corrosion. A series of experiments was also made upon the effect of sulphuric acid of 1·56 to 1·76 sp. gr. upon the several metals which occur in commercial leads, and upon lead in the presence of each of these metals. It was found that

Pb and Bi alloy in boiling acid of 1·565 to 1·661 sp. gr. Probably when Bi is present in pan lead an alloy is formed, when the necessary temperature is reached, upon which the acid has an effect, the action thus taking place suddenly. Sn probably tends to act in the same way. Chemically, at certain stages of the concentration, sudden action becomes possible in the presence of Al, Sn, or Zn, or to a less degree in the case of Bi. The presence of Sb may cause a strong harmful effect chemically, whilst Cu, As, and Ag have little effect; Cu can exert a corrective influence under certain conditions, which, lapsing when the Cu has in the course of time dissolved away, leaves the lead which may have given good results for a long period, open to the effects of more injurious impurities. Pure Pb is under normal conditions undoubtedly less affected than impure lead. Through having been cast at too high a temperature, or through having been submitted to too severe mechanical treatment, the metal may behave as if it were locally weak, or it may be more susceptible to acid attack, apart from the degree of purity of the metal. As the Betts electrolytic process of lead refining gives a metal which is free from Bi, the author regards it as favourable for the production of lead for the purpose in question. In the *discussion*, **W. H. Coleman** gave an instance in which a failure was traced to the presence of Bi. When Pb is used for saturation the seams are attacked first. He was of opinion that this was due to the introduction of As from burning with H from Zn; he had found that lead burnt with coal-gas and oxygen lasted much longer. Seams should not be left rough; otherwise they form a starting-point for attack. F. R.

1233. *Surface Tension of Aqueous Solutions.* II. **Géza Zemplén.** (Ann. d. Physik, 22. 2. pp. 391–396, Feb. 5, 1907. Hochschule f. Forstwissenschaft, Selmeczbánya, Ungarn.)—The author shows that the experimental data of W. Grabowsky and G. Pann confirm the accuracy of the proposition he has already enunciated, viz., that Eötvös's principle is applicable to aqueous solutions with the same degree of accuracy as to homogeneous liquids; in other words, the process of solution does not effect the degree of association of the water. [See also Abstract No. 338 (1907).] D. H. J.

1234. *Adsorption in Solutions.* **H. Freundlich.** (Zeitschr. Phys. Chem. 57. pp. 385–470, Dec. 21, 1906. Habilitationsschrift, Leipzig.)—Experiments made on the adsorption of dissolved substances by carbon showed that a well-defined equilibrium occurs which can be reached from either side. The adsorption is usually expressible by an exponential function of which the index is at a given temperature almost independent of the nature of the solvent, solute and adsorbent (carbon, silk, cotton, wool), but this expression does not apply in the case of aqueous solutions of strongly dissociated bases. The adsorption from aqueous solutions is slight in the case of inorganic salts and acids, moderately strong organic acids and sugar, fairly marked in the case of moderately strong aliphatic and aromatic-sulphonic acids, very strong in the case of aromatic acids, chlorine, bromine, phenylthiocarbamide, &c. On the other hand, these last substances, although strongly adsorbed from solutions in water, Glauber's salt, sulphuric acid, &c., are only feebly adsorbed from alcohol, ether, anisol, benzene, acetone, &c. The adsorption is usually independent of the nature of the adsorbent; thus the order in which the organic acids are adsorbed by silk is practically the same as for carbon, and picric acid is almost equally adsorbed from water and from alcohol, by carbon and by silk. The effects are therefore explained on a mechanical theory, in which surface tension is the chief factor, the view being advocated that substances which lower the surface tension between solid and liquid must be adsorbed and *vice-versâ*. Since negative adsorption (*i.e.*, adsorption of the *solvent* from the solution) was not observed, the conclusion is drawn that the addition to a solvent of a small quantity of a solute must regularly have the effect of lowering the surface tension between the liquid and a solid surface; so also the surface tension of a liquid mixture may sink to a minimum value but not rise to a maximum at intermediate concentrations. T. M. L.

1235. *Compressibility and Vapour Pressure of Mixtures of Methyl Ether and Sulphur Dioxide: Formation of a Compound between the Two Substances.* **E. Briner** and **E. Cardoso.** (Comptes Rendus, 144. pp. 911–918, April 29, 1907.)—On comparing the compressibilities and vapour pressures of sulphur dioxide and methyl ether with those of mixtures of these substances in various proportions, it is found that for the mixture corresponding with $(CH_3)_2O + SO_2$ the vapour pressure has a minimum value and that liquefaction occurs almost without increase of the pressure, which is not the case for other mixtures. It is hence concluded that a compound exists having the formula $(CH_3)_2O, SO_2$. The critical temperature and pressure are $152{\cdot}5 \pm 0{\cdot}5^\circ$ and 62 ± 1 atmos. respectively, these values being intermediate to those for the two components in both cases. T. H. P.

1236. *Vapour Pressure of Aqueous Nitrate Solutions.* **A. T. Lincoln** and **D. Klein.** (Journ. Phys. Chem. 11. pp. 318–348, April, 1907.)—The air-saturation method of determining the vapour pressures of solutions gives very accurate results if the solutions are agitated; the air aspirated through the solutions is saturated with aqueous vapour, that is, it is in equilibrium with the liquid phase. The statement, made by Regnault and by Tammann, that the rate of aspiration has no effect on the vapour pressure is confirmed. Results are given of measurements of the vapour pressures of solutions of potassium, sodium, and lithium nitrates of various concentrations. The values for the vapour-pressure lowerings give values for the molecular weights which, with potassium nitrate, are in general accord with what would be expected on the basis of the electrolytic dissociation theory, whilst with sodium and lithium nitrates this is not the case. If Raoult's formula is applicable to concentrated solutions, the molecular weight of lithium nitrate is far below the value required by the dissociation theory at complete dissociation; these values decrease with increasing concentration. The lowering of the vapour pressure is apparently not solely a function of the number of parts in solution, but the individuality of the particular salt manifests itself and must be taken into consideration. T. H. P.

1237. *Critical Temperature of Solution in Ternary Mixtures.* **J. Timmermans.** (Zeitschr. Phys. Chem. 58. pp. 129–218, Feb. 19, 1907. Phys.-chem. Inst. der deutsch. Univ., Prag.)—The author has divided the subject into: (1) Influence of a third body on the miscibility of two liquids, under three heads, depending on relative solubilities, and (2) consideration of phenomenon from the standpoint of the phase-rule; (3) optical properties of opalescence and refractive index. In the first part particular attention is paid to the abnormal increase due to the dissociation of electrolytes. The results are compared with van't Hoff's equation [Chem. Weekblad, 1. p. 93, 1903].

The consideration of the phase-rule shows the existence of retrograde mixing and freezing with two liquids and one solid, the example taken being water, phenol and sodium chloride. It is also found that a critical temperature of solution and a maximum saturation temperature exist. A useful table is given comparing the nomenclature for solution and evaporation temperatures. In the experimental portion various methods are compared and a complete set of numerical data given. Special series of comparative results, with various electrolytes, appear in all groups, followed by a complete bibliography of work on ternary systems. The following points may be noted in addition to those given above: 1. The critical solution temperature is analogous to the critical vaporisation temperature. 2. A third substance, if soluble in both liquids, increases their mutual solubility; this allows the critical point to be reached with slightly soluble substances at the ordinary temperature. 3. This principle shows the existence of a negative saturation temperature with miscible liquids. 4. A special research shows the analogy of (1) is the result of a real continuity. 5. The critical point is most easily found by the opalescence. [See also Abstract No. 852 (1907).]

H. H. F. H.

1238. *Osmotic Pressure from the Standpoint of the Kinetic Theory.* **T. M. Lowry.** (Phil. Mag. 13. pp. 552–559, April, 1907. Communicated by the Faraday Soc.)—After a short discussion of previous attempts to explain osmotic pressure on the basis of the kinetic theory, the author puts forward the following theory: In the case of a solution of a non-volatile solute in a volatile solvent, the surface will contain both kinds of molecules. "If one of the solvent molecules be struck by a rapidly moving molecule from the interior of the liquid, it will be projected into the vapour space. If, however, one of the non-volatile molecules be struck, it will be unable to escape, and the solvent particle will rebound in much the same way as if it had struck the wall of the containing vessel. The rate of evaporation is therefore reduced by the addition to the solvent of a non-volatile solute. On the other hand, it *is probable that the presence of the non-volatile molecules would not interfere with the rate of condensation of the vapour.*" From the assumption that there is a uniform distribution of molecules at the surface, it follows that the rates of evaporation from unit surface of solvent and solution will be in the ratio $(N + n)/N$, where N is the number of gm.-mols. of solvent and n that of solute in unit volume of solution. This is as required by the formula connecting osmotic pressure and vapour pressure, viz., $N/(N + n) = p'/p$, where p' is the vapour pressure of the solution, and p that of the solvent. The author also briefly discusses the behaviour of concentrated solutions, the formation of complexes, and the connection between osmotic pressure and surface tension.

A. F.

1239. *Physical Properties of Emulsions.* **E. Bose.** (Phys. Zeitschr. 8. pp. 347–353, May 15, 1907.)—Eichwald, Schenck, and Bühner have separately found that apparent discontinuity of viscosity occurs when a crystalline liquid passes by rise of temperature from the turbid to the limpid condition, and they consider this behaviour antagonistic to Tammann's theory of emulsions, since flow-experiments on two binary mixtures apparently show no such discontinuity in the neighbourhood of the temperature of disappearance of turbidity. But Poiseuille's theory cannot be applied to emulsions, and the relation between optical quality and molecular structure is really unknown, so that the antagonism is not proved. Indeed, as the suspended drops in an emulsion tend to coaggregate, the viscosity of an emulsion and its speed of flow through a tube must be functions of its age, and this special dependence of the speed of flow on the state of coaggregation is shown by Eichwald's own experiments, which are here examined, the results being easily explained on the assumption that different components of an emulsion have different viscosities. The apparent discontinuity in the density on the passage from one state to the other can similarly be explained; and the observation of an abrupt bend in the cooling curve of an emulsion-forming mixture at the temperature corresponding to the beginning of the emulsion-state is only to be expected, as limpidity betokens complete miscibility which does not in general occur without absorption or emission of heat. R. E. B.

1240. *van der Waals' Equation and the Liquid State.* **P. Bogdan.** (Annal. Scientifiques de l'Univ. de Jassy, 4. pp. 151–161, Jan., 1907.)—If a liquid expands by evaporation by the amount dv, the work performed is $(p + K)dv$, where p is the external pressure and K the force of attraction between the liquid molecules. Introducing for $p + K$ its value obtained from van der Waals' equation $(p + K)(v - b) = RT$, and integrating, Clausius' well-known equation for the heat of evaporation is obtained. From the latter, without any further assumption concerning the molecular state of solvent and solute or any other hypothesis, van't Hoff's laws for the raising of the boiling-point and lowering of the freezing-point can be derived, by introducing for the lowering of vapour pressure, $(P - p)/P$, the value $n/(N + n)$. [See also Abstract No. 446 (1905).] T. H. P.

1241. *Evaluation of Partial Pressures of Binary Mixtures.* **E. Bose.** (Phys. Zeitschr. 8. pp. 858–858, May 15, 1907.)—If p_1, p_2 are the partial pressures of a mixture containing $1 - x$ and x gm.-molecules of two substances respectively per gm., then, according to Duhem, $y = z$ where—

$$y \equiv \frac{p_1}{p_2} \quad \text{and} \quad z \equiv -\frac{x}{1-x}\,\frac{dp_1/dx}{dp_2/dx}.$$

The author proposes to determine the partial pressures thus when the total pressure $\pi \equiv p_1 + p_2$ is known in terms of x. Plot the values of π with x as abscissæ; then draw two smooth curves fairly similar to each other, but one with ordinates from π to 0 and the other with ordinates from 0 to π as x increases from 0 to 1; calculate the values of y and z for evenly distributed values of x; these will, of course, not in general be equal, since the curves are arbitrarily drawn, but use their means to recalculate values of p_1, p_2 for the values of x, and, having obtained fresh partial pressure curves by plotting these values, repeat the process, and repeat again until satisfactory agreement of the values of y and z is obtained. By employing this process Bose finds results more in agreement with Zawidzki's observations on six different mixtures [see Abstract No. 171 (1901)] than are deducible from Zawidzki's formulæ. By a similar method when the partial pressures of one component of a binary mixture are known those of the other component can be determined. The case of aqueous solutions of ammonia at 0° C., for which the partial pressures of ammonia are known, is considered; and by three approximations steady values for the partial pressure of the water vapour are obtained. The method is certainly laborious, and the drawing of the curves and the estimations of their slopes demand care. R. E. B.

1242. *Binary Mixtures: the Three-phase Line Solid—Liquid—Vapour.* **P. Kohnstamm.** (Konink. Akad. Wetensch. Amsterdam, Versl. 15. pp. 782–742, March 6, 1907. Proc., 9. pp. 639–648, March 28, 1907.)—It has been assumed by Smits [Abstract No. 1994 (1905)] and others that when the solid substance is one of the components, there is usually a temperature maximum. This appears from the discussion not to be the case beyond as a rare exception. The need of data on the values of *a* and *b* of non-volatile substances is very urgent in this connection. It appears that a pressure maximum will occur except when $(xv/xl)_{x=0}<7$, for then the entropy equation will be negative, which is the required condition. Here also data are very necessary. H. H. F. H.

1243. *Metastable and Unstable Equilibria Solid—Fluid.* **P. Kohnstamm.** (Konink. Akad. Wetensch. Amsterdam, Versl. 15. pp. 742–754, March 6, 1907. Proc., 9. pp. 648–660, March 28, 1907.)—A continuation of the former paper [see preceding Abstract]. There appears to be a want of agreement between the *p.x.* curves given by Smits, the *p.t.* of van der Waals, and the *v.x.* of the former. The *v.x.* figure is discussed in detail, but this cannot well be abstracted. Many figures illustrating the various cases are given. H. H. F. H.

1244. *Further Studies of Supercooled Liquids.* **S. W. Young** and **W. E. Burke.** (Amer. Chem. Soc., Journ. 29. pp. 329–339, March, 1907.)—The authors have studied the condition under which *p*-nitrotoluene undergoes supercooling and arrive at the following conclusions. In some tubes supercooling takes place habitually to a greater extent than the normal, while in other tubes the supercooling is habitually less. The majority of the tubes, however, show no habit—the degree of supercooling in them being sometimes greater, sometimes less than the average. The longer the period during which the contents of a tube are heated above their melting-point, and the higher the temperature of heating, the less readily does solidification occur. The "sterilisation" thus produced is only to a small extent permanent, possibly owing to some chemical change which occurs. When the contents of the tube have remained solid for some considerable time, solidification, after remelting, takes place less readily. The nuclear hypothesis, previously advanced, will explain the influence of time and temperature of heating, but not that of the time in the solid state. A. F.

1245. *Thermodynamics of Liquid Cells.* **P. Henderson.** (Zeitschr. Phys. Chem. 59. pp. 118–127, April 23, 1907. Communication from the Inst. f. physikal. Chemie, Göttingen.)—For the e.m.f. of liquid cells of the type Hg | Hg_2SO_4 | H_2SO_4 | Na_2SO_4 | Hg_2SO_4 | Hg, the author has derived a thermodynamic formula which has the form—

$$e=\frac{RT}{F}\cdot\frac{(u_1-v_1)-(u_2-v_2)}{(u'_1+v'_1)-(u'_2+v'_2)}\log_e\frac{u'_1+v'_1}{u'_2+v'_2}.$$

Measurements of several cells show satisfactory agreement with the theory. A. F.

1246. *Determination of the Absolute Potential of the Calomel Electrode.* **W. Palmaer.** (Zeitschr. Phys. Chem. 59. pp. 129–191, April 30, 1907. Elektrochem. Laborat. d. techn. Hochschule, Stockholm, Nov., 1906.)—

The method used is that of the mercury-drop electrode [see Abstract No. 1551 (1901)], as suggested by Nernst and first tried by Amelung. When drops of mercury fall through a solution of mercury salt, an electromotive force is produced by changes in the concentration. When the osmotic pressure p of the Hg-ions in the solution is greater than the electrolytic solution tension P of the metal, Hg-ions will be condensed on the new drop; the drop thus positively charged will surround itself with a layer of anions from the solution, and salt will be carried downward by the falling drop. So long as $p > P$, a current will therefore flow in one direction, and when $p < P$, this current will flow in the opposite direction. The author tries to reduce the p-pressure, in order to produce the current reversal first observed by Paschen, in a null-solution. When afterwards a couple is built up: Hg | null solution | KCl and Hg_2Cl_2 | Hg, the e.m.f. at the junctions being in this order: $e_1 = 0$, e_2, e_3, then the total e.m.f. of the couple $E = e_2 + e_3$, and if e_2 is made so small that it can be neglected, e_3 can be calculated. The mercury is forced through 120 fine furrows in a glass stopper; the electrolytes are solutions of KCN or H_2S; other solutions have not proved suitable so far, but amalgams are to be tried. As the air must be excluded, lest Hg be dissolved, the experiments with KCN, which are described in detail, are conducted in a hydrogen atmosphere. The absolute potential of the decinormal calomel electrode is −0·57358 volt in KCN, and −0·57296 volt in H_2S. After the preliminary publication of the results [Abstract No. 2963 (1904)] in 1903, Billitzer gave the value +0·1. The author criticises Billitzer's research, but admits that, according to Krüger and Warburg, there might be some condensation of salt on the surface of the mercury; the correction required for this reason would, however, be small. A list of the literature on electro-capillary phenomena, beginning with Lippmann's *résumé* of 1875, is added. H. B.

1247. *Chemical Reactions at the Iron Electrode in Jungner-Edison Accumulators.* **O. Faust.** (Zeitschr. Elektrochem. 13. pp. 161–165, April 26, 1907. From the Inst. f. physikal. Chemie d. Univ., Göttingen. Centralblatt Accumulatoren, 8. pp. 72–73, May 5, 1907.)—The author determines the potential of iron electrodes of the Kölner Akkumulatorenwerke G. Hagen against a zinc-amalgam electrode immersed in KOH, in which some $Zn(OH)_2$ is also dissolved. The iron electrode is first overcharged; the discharge, recovery, and charge curves are reproduced; the recovery took weeks in some cases. Like Gräfenberg [see Abstract No. 1225B (1905)], the author finds three stages in the discharge, and also in the charge curves. The active substance of the first discharge stage is the hydrogen occluded by the iron; the active substance of the second stage is the iron itself; in the third stage a higher oxide, probably Fe_3O_4 or its hydroxide is formed, and the potential goes up to 1·9 volts, when oxygen is liberated. The ferrous hydroxide (not the ferric, nor the ferroso-ferric hydroxide) is soluble in ammonia, and this solution can easily be oxidised electrolytically to ferroso-ferric hydroxide (black-green) and to ferric hydroxide (brown), spongy iron being formed at the kathode. Further particulars of these reactions are to follow. H. B.

1248. *Chemical Effects of the Electric Discharge in Rarefied Hydrogen and Oxygen.* **P. J. Kirkby.** (Phil. Mag. 13. pp. 289–312, March, 1907.)—The author explains the chemical effect previously observed [Abstract No. 1268 (1905)] when electricity is passed through a mixture of hydrogen and oxygen at low pressures by supposing that the gaseous ions, as they pass from their origin to the electrodes, break up into uncharged atoms those molecules of the gas which they strike under favourable conditions, and thus set the atoms free to group themselves afresh into molecules of water vapour. Confirmation of this hypothesis is now furnished by investigation of the phenomena observed when a rarefied mixture of oxygen and hydrogen in equivalent proportions is subjected to the large, steady currents passing between parallel plate electrodes and accompanied by a glow. When the electrodes are far apart, the velocity of reaction per coulomb increases as the gas pressure falls, and reaches a maximum at a pressure of 1·4 mm. The velocity increases moderately rapidly as the distance between the electrodes is increased to 2 cm., after which the increase is very slow; with very low external pressures, the increase of the velocity of reaction is more regular. At the lower pressures the number of impacts made by an ion in passing through 1 cm. is less than at higher pressures; but this is apparently more than counterbalanced by the greater velocities with which the ions impinge on the gaseous molecules. A small amount of ozone is formed as a result of the dissociation of the gas molecules. Experimental corroboration is obtained of the conclusion that the kathode column is the seat of greatest chemical activity. T. H. P.

1249. *Electromotive Force of Iron and Influence of Occluded Hydrogen. A reply.* **E. Heyn.** (Zeitschr. Phys. Chem. 58. pp. 760–761, April 9, 1907.)—Richards and Behr [Abstract No. 923 (1907)] have stated that when iron sponge is suddenly cooled from a high temperature in water, it takes up hydrogen from water. In connection with this the author considers that it is not altogether proved, and that, in any case, as his experiments show, the statement can refer only to iron sponge, and not to iron in general. A. F.

1250. *Stationary State between Polarised Hydrogen Electrodes.* **A. Eucken.** (Zeitschr. Phys. Chem. 59. pp. 72–117, April 28, 1907.)—The author has investigated theoretically the connection between current and potential for the stationary state, the current being residual current, especially in acid solutions both without and with addition of a salt having a like ion. The theory was satisfactorily borne out by experiment. By means of the study of the residual current the author also determined the diffusion coefficient of some organic acids. The author has also investigated the variation of resistance and polarisation, especially in pure acid solution, and found a qualitative verification of the assumption that both polarisation and resistance tend towards a constant limiting value with increase of potential. A. F.

1251. *Experimental Investigations upon the Combustion of Air in the Flame-arc.* **A. Grau** and **F. Russ.** (Akad. Wiss. Wien, Sitz. Ber. 115. 2a. pp. 1571–1657, Dec., 1906. From the Technolog. Gewerbemuseum, Wien.)—The authors have carried out a very elaborate series of investigations upon the relation between the size of flame and power used in producing it, and the amount of nitrogen oxide gases formed in the different zones of the arc. A Pt capillary tube cooled by water was employed for withdrawing the air and nitrous gases from any portion of the flame-arc, while the latter in some of the experiments was enclosed in a quartz-glass tube to obtain greater steadiness and more accurate measurements of its length. The temperature of the flame was not taken by direct methods of observation since none of these proved reliable, but was calculated from the yield of nitrous gases, by aid of Nernst's formula. The best results showed that an energy efficiency of 81·4 per cent. could be obtained, equivalent to 545 kg. HNO_3 per kw.-year, with a flame 5 cm. in length using a current intensity of 0·10 amp. and total energy of between 168 and 170 watts in the arc. With a shorter flame (3 cm.) the efficiency was lower, the highest yield in this case being equivalent to 454 kg. per kw.-year, or 58 per cent. The authors, therefore, remark that it is probable that as the size of the flame-arc increases, the yield and efficiency will increase also, more especially as the electrical energy required to produce a flame-arc 5 cm. in length was found to be less in proportion than that required to produce an arc flame 3 cm. in length; the watts per cm. being 32·6 and 36·0 respectively. [See also Abstract No. 876B (1907).] J. B. C. K.

1252. *Electrolytic Preparation of Chloroform.* R. **Trechcinski.** (Berichte des Elektrotechn. Inst. Kaiser Alexander III., Petersburg, No. 3, 1906. Zeitschr. Elektrochem. 13. p. 60, Feb. 22, 1907. Abstract.)—Chloroform can be prepared by the electrolysis of $CaCl_2$ in presence of ethyl alcohol. The best yields (up to 54 per cent. of the theoretical amount) are obtained by using 40–70 gm. of $CaCl_2, 6H_2O$ per 100 c.cm. of water and 1–2 per cent. of alcohol, a current density of 8 amps./cm.² and a temperature lying between 50° and 78°. The voltage does not affect the yield provided it is above 2·2, below which no chloroform is obtained. The $CaCl_2$ may be replaced by a concentrated solution of either potassium or sodium chloride, the best conditions then being 1–2 per cent. by volume of alcohol, a current density of 15 amps./cm²., a temperature of 70–80° and a voltage of 3–7. T. H. P.

1253. *Electrolytic Preparation of Bromoform.* R. **Trechcinski.** (Berichte des Elektrotechn. Inst. Kaiser Alexander III., Petersburg, No. 3, 1906. Zeitschr. Elektrochem. 13. p. 60, Feb. 22, 1907. Abstract.)—The best yield (49·6 per cent. of the theoretical amount) of bromoform, prepared by an electrolytic method similar to that employed for chloroform [see preceding Abstract], is obtained from a solution containing 165 gm. of calcium bromide, 100 gm. of water, and 4·5 c.cm. of alcohol, the current density being 24 amps./cm.² and the temperature 88°–92°. T. H. P.

1254. *Preparation of Spongy Chromium.* B. **du Jassonneix.** (Comptes Rendus, 144. pp. 915–917, April 29, 1907.)—At a high temperature Cu dissolves about 1·6 per cent. of Cr, which separates in a spongy form on cooling and may be freed from Cu by extraction with nitric acid. The new variety of Cr has a density at 17° C. of 7·1. W. H. Si.

1255. *The Electrolytic Production of Calcium.* C. **Bürgel.** (Elektrochem. Zeitschr. 13. pp. 209–211, Jan.; 237–239, Feb.; 262–266, March; 14. pp. 11–14, April, and pp. 28–31, May, 1907.)—The author discusses at length the experiments of Goodwin on the electrolysis of fused $CaCl_2$ in Acheson graphite cylinders, the bottoms of which are kept cool by means of a copper coil covered with fluor-spar. He then passes to the experiments of ten years ago of Rathenau and Suter, who first suggested the use of a contact-electrode, that is to say, a kathode which only touches the surface of the bath and is raised as the calcium cools on it. This process was taken up by the Elektrochemische Werke Bitterfeld, and improved by Borchers and

Stockem, Redlich, and Ruff and Plato; the latter add fluor-spar to the bath in order to lower the melting-point of the electrolyte while maintaining a high density to secure a rapid rise of the calcium. A second article is to follow. H. B.

1256. *Optical Investigation of Aluminium Anode Films.* **O. M. Corbino.** (N. Cimento, 12. pp. 113–136, Sept., 1906. Electrician, 58. p. 569, Jan. 25, 1907. Abstract.)—The observations were made with a Babinet compensator not specially adapted for the purpose, hence no great accuracy is claimed for the results. The thickness of the film formed at 61 volts in sodium potassium tartrate solution is found to be 0·18 μ; at 110 volts 0·28 μ, and at 145 volts 0·3 μ. It is noteworthy that the formation voltage divided by the film thickness = a constant, as also the product of capacity and thickness. The purely optical details should be referred to in the original. All conclusions lead the author to the view that the polarisation theory must be abandoned and that the existence of a true dielectric stratum must be admitted, which latter, owing to its tenuity, is masked by the external nearly transparent semi-conducting skin that is optically visible. L. H. W.

1257. *Behaviour of the Magnesium Anode.* **S. Maresca.** (N. Cimento, 12. pp. 155–163, Sept., 1906.)—The formation in caustic soda solution was so irregular that the author was unable to measure the electrostatic capacity; he therefore employed a solution of potassium carbonate, of density 1·40. In this electrolyte he was able to form magnesium anodes of 20 cm.^{2} at voltages from 5 to 30. Even a formation voltage of 100 can be reached if the voltage is gradually increased. At 30 volts anodes of the above size give the following readings for the current: When first switched on, 0·25 amp.; after 1 min., 0·235; 2 min., 0·20; 3 min., 0·15; 4 min., 0·015; 5 min., 0·005; 10 min., 0·001 amp. Formed at 60 volts such an anode has a capacity of 1·9 mfd. after formation for 10 min., which decreases to 1·4 mfd. after 4 hours and then remains unaltered. The product of volts and capacity is constant as in the case of the aluminium anode [see preceding Abstract]. When the applied voltage is rapidly altered to a lower value the capacity is different from that which it would have if formed direct at the lower voltage. Some condition must hence persist on the anode, which indicates the maximum voltage to which it has previously been subjected. If, however, it is left for a long time at a lower voltage, the anode slowly acquires the capacity corresponding to direct formation at that voltage; and in this respect the magnesium anode differs in its behaviour from the aluminium anode. L. H. W.

1258. *Electrolytic Precipitation of Copper from an Alkaline Cyanide Electrolyte.* **A. L. Flanigen.** (Amer. Chem. Soc., Journ. 29. pp. 455–459, April, 1907. Contribution from the John Harrison Lab. of Chemistry.)—Hitherto the quantitative deposition of Cu from a cyanide electrolyte has been considered unsatisfactory, because the Pt anode is dissolved to some extent, and the Pt may be deposited at the kathode. The author shows that under the following conditions the results are quantitative, and the deposits contain no Pt. The Cu solution should contain but a slight excess of potassium cyanide over that necessary to dissolve the precipitate first formed, and should be heated (65° C.) in order to lessen the time of deposition; current density of 0·2 to 0·6 amp. per sq. dm. and 4 volts; minimum time 1¼ hours for 0·2015 gm. Cu. The addition of 10 c.cm. of ammonia (sp. gr. 0·98 at 24° C.) to the cyanide solution gave very satisfactory results, and the time of deposi

tion was 1 hour at 65° C.; 5 volts and current density of 0·66 to 1 amp. per sq. dm. A greater volume of ammonia lengthens the time of deposition and gives unsatisfactory deposits. Satisfactory results were also obtained with a rotating anode, the time of deposition being 10 min. Copper was successfully separated from iron, both when the quantity of the former was twice that of the latter, and when the quantity of Fe greatly exceeded that of the Cu.
T. S. P.

1259. *Contribution to the Theory of the Aluminium Anode.* **A. Roubanne.** (Jurn. Russk. Fisik.-Chimičesk. Obščestva, 39. No. 4. Physical Part, pp. 116–122, 1907.)—Following Taylor and Inglis' view that if a membrane of $Al(OH)_3$ separates the two electrolytes the different ions pass through the membrane in a different way, the author shows that a $Cu_2Fe(CN)_6$ membrane manifests the same properties, especially when the electrolytes separated are LiCl and $BaCl_2$; the ratio of the ohmic resistances for current flowing in the two directions is 1/2. In the case of ions of the electrolytes $CuSO_4$ and $K_4Fe(CN)_6$ passing through a porous cylinder, and themselves constituting the membrane for one determinate direction of the current, the ratio of the resistances is still more unequal, being 1/5. With the other membranes examined the results were not so pronounced.
L. H. W.

1260. *Behaviour of Tantalum Anodes.* **G. Schulze.** (Ann. d. Physik, 23. 2. pp. 226–246, June 18, 1907. Communication from the Physikal.-Techn. Reichsanstalt.)—The author has extended his previous work [Abstracts Nos. 156 and 924 (1907)] to an examination of the behaviour of tantalum as anode. The metal was in the form of thin rods. It is found that formation takes place considerably more rapidly than in the case of aluminium, the end voltage being reached after a few min. No electrolyte was found which did not give a "valve" effect, although hydrofluoric acid was not tried, in which Ta should be soluble. Tables are given showing the max. voltage obtainable across the cell with an applied voltage of 650, and stating the approx. concentration, and whether the formation is slow, medium, fast or very rapid. The lowest max. voltages are found with $KMnO_4$, $K_2Cr_2O_7$ and $K_4Fe(CN)_6$. The best results are obtained with K_2CO_3, in which electrolyte the formation is very rapid and the max. voltage observed is about 200 volts at 10 per cent., 400 volts at 1 per cent., 700 volts at 0·06 per cent., and over 900 volts at 0·02 per cent. concentration; the voltage loss in the electrolyte at a current density 0·005 amp./cm.^{2} was only 8 volts. The valve effect is much less influenced by rise of temperature than with aluminium, a temperature of 50° C. giving a max. voltage of 800 volts; at 75° and 95° C. the curve is more steep and only with higher current densities, >0·002 amp./cm.^{2}, is this max. voltage obtainable. The chief disadvantage is that the film is sensitive to any cutting off of the applied voltage. Measurements of the capacity show that the film at first rapidly thickens on the current being cut off, and then continues doing so, but more slowly. The thickness of the gas layer is found—unlike in the case of aluminium, in which the layer will quickly increase in thickness corresponding to the applied p.d.—to only very slowly change when an increased voltage is applied. The potential gradients in the non-effective direction do not agree with Hobbs' values for sparking-voltages for very small distances.
L. H. W.

1261. *Electro-reduction of Hydroxylamine and Nitrous Acid.* **O. Flaschner.** (Akad. Wiss. Wien, Sitz. Ber. 116. 2b. pp. 105–142, Jan., 1907. From the physikal.-chem. Inst. d. deutsch. Univ., Prag.)—In electrochemical reductions the method of "graded potential" possesses only limited applicability. "Grading" is only possible when the diminution in the percentage of oxygen of the substance reduced is accompanied by a decrease in the oxidation potential. There is, however, no connection between the percentage of oxygen and the value of the oxidation potential (*e.g.*, nitrosobenzene, a reduction product of nitrobenzene, has a higher potential than the latter); consequently the successful application of graded potentials is a matter of chance. The metal of which the kathode is made may act catalytically on the various processes which take place, and thus obscure the results obtained. So far it has not been proved that every reduction takes place in stages, but the occurrence of intermediate stages is plausible from kinetic considerations. In the practical part of the paper the author measured (1) the decomposition potentials of solutions of hydroxylamine sulphate, (2) the amount of reduction (to ammonia) which took place, using kathodes of different metals. The results of the two sets of experiments confirmed each other. The velocity of reduction of hydroxylamine—also of nitrous acid—varies with the material of which the kathode is made; the same kathode potential does not give the same strength of current. The velocity is greatest with platinised Pt, although this kathode gives the lowest potential, and this must be ascribed to the catalytic effect of the deposited Pt. Amalgamated lead gives the highest potential, but the velocity of reduction is only 1/14th of that with platinised Pt. Other kathodes, which occupied intermediate positions between platinised Pt and amalgamated lead, were smooth Pt, Cu, Ni, Sn, and Pb. The rule of graded potential cannot be applied to the reduction of nitrous acid, since even with low kathode potentials the end product (ammonia) of the reduction results. With copper kathodes both nitric and nitrous acids are reduced to ammonia, no hydroxylamine being formed; with kathodes of platinised Pt and amalgamated lead hydroxylamine is formed to some extent when high potentials are used. All the experiments on the quantitative reduction were so arranged that there was no liberation of hydrogen at the kathode; in spite of this there was always a loss of current. This loss is probably accounted for by some hydrogen being deposited and then dissolving in the kathode, from which it diffuses either into the solution, where it is oxidised by the dissolved oxygen of the air, or else into the air. The influence of temperature on the reduction of nitrous acid is very small. The results do not offer an explanation of the reduction of nitric acid straight to ammonia when copper kathodes are used, whereas with kathodes of lead and mercury hydroxylamine is formed.

T. S. P.

1262. *Experiments on the Manufacture of Chlorates and Hypochlorites with a view to High-current Efficiency.* **A. G. Betts** and **R. H. Sherry.** (Amer. Chem. Soc., Journ. 29. pp. 340–345, March, 1907.)—The authors have tested the effect of various additions to the bath, and also of various electrodes in promoting an increased current efficiency. It was found that the use of magnesium as kathode has a number of advantages, especially when the brine flows through a series of cells. On account of the extent to which Mg is attacked in fresh solutions, when no alkali is present, it seems better to use carbon electrodes in the first cell, and Mg kathodes, with carbon anodes, in the following cells. The addition of alkali diminishes the loss of Mg. The great advantage in the use of the Mg kathode would seem to be not only the lower power cost, but that a large quantity of the salt can be converted, it being possible to convert from 35–50 per cent. of the salt with an efficiency of 60 per cent. If more cells were used with Mg kathodes the efficiency would be increased owing to the decrease in the proportion of graphite used as kathode. A. F.

1263. *Electrolytic Determination of Tin, using a Rotating Anode.* **L. F. Witmer.** (Amer. Chem. Soc., Journ. 29. pp. 473–477, April, 1907. Contribution from the John Harrison Lab. of Chemistry.)—Successful electrolytic determinations of tin were made, using a rotating spiral anode and a Pt dish kathode. Solutions of stannous ammonium chloride and of stannic chloride, containing varying amounts of ammonium sulphide in excess of that necessary to dissolve the precipitate first formed, were electrolysed hot (temperature not stated). With currents of about 5 amps. (current density not given) and 7 to 10 volts, over 0·13 gm. of tin can be deposited in 20 min., and over 0·25 gm. in 25 min. The character of the deposit varies with the amount of tin; *e.g.*, in one case all the deposits weighing 0·1840 gm. or less were bright silver-white in colour, while they were finely crystalline and light grey when this amount was exceeded. The speed of rotation of the anode had little or no effect on the character of the deposit. Up to 0·8 gm. nothing was occluded in the deposit, but above that weight the results were always too high, and the deposits were spongy, although adherent. Washing with CS_2 did not cause a decrease in weight. T. S. P.

1264. *Electrolytic Determinations and Separations, using a Rotating Anode.* **J. Langness.** (Amer. Chem. Soc., Journ. 29. pp. 459–472, April, 1907. Contribution from the John Harrison Lab. of Chemistry.)—A new form of anode has been devised to use with a dish kathode. It consists of a Pt dish (7 cm. diam. and 3 cm. deep) of the same general form as the kathode, the sides of which are provided with 10 slits perpendicular to the edge, each slit about 1·8 cm. long and 0·5 cm. wide. These openings, together with a circular opening 1·3 cm. diam. in the bottom of the dish ensure free circulation of the liquid. It is so adjusted that it is equidistant from and close to the sides of the kathode. During the rotation of the anode the liquid is all contained within the space bounded by the kathode and the outer surface of the anode, no liquid remaining within the inner dish; when properly adjusted there is no splashing of the liquid. The volume of the electrolyte did not exceed 65 c.cm. An abstract of the results is given in the following table:—

Metal.	Electrolyte.	Volts.	Amps.	Time.
0·4884 gm. Cu	$CuSO_4 . H_2SO_4$	7–8	10–16	8 min.
0·4817 „ Cu	$CuSO_4 . HNO_3$	8	16	6 „
0·4888 „ Cu	Cyanide	7	15	6 „
0·58 „ Ag	Cyanide	5	10	2 „
0·5 „ Ni	$Am_2SO_4 . AmOH$ ...	6	11–16	5 „
0·2472 „ Zn	NaOH	6	18	8 „
0·1978 „ Pt	$K_2PtCl_6 . H_2SO_4$	10	17	5 „
0·5357 „ Pd	$Pd(NH_3Cl)_2 . AmOH$	17	14–20	2 „
0·1152 „ Rh	$Na_3RhCl_6 . H_2SO_4$ ...	7	15	8 „

The current density is not stated in any case. The following separations were also successfully carried out, using a cyanide solution in each case, and grading the voltage: Au from Pt and Pd; Cu and Ag from Pt; Ag from Cu; Ag and Cu from Pt, the Ag first being deposited and then the Cu; Ag from Ni, and Ag from Zn. T. S. P.

1265. *Quantitative Estimation of Antimony by the Electrolysis of Solutions of its Thiosalts.* **F. Foerster** and **J. Wolf.** (Zeitschr. Elektrochem. 13. pp. 205–210, May 10, 1907. From the Laborat. f. Elektrochem. u. physikal. Chemie an d. techn. Hochschule, Dresden.)—The authors confirm the statement that the electrolytic deposition of Sb from solutions containing the complex thiosalts and potassium cyanide gives too high results, and they further show that the high results are due to the presence of oxygen and traces of sulphur in the deposited Sb [see Dormaar, Abstract No. 983 (1907)]. These impurities are possibly present in the form of a solid solution of oxide and sulphide of Sb in metallic Sb. It is also shown by coulombmeter measurements that Sb is deposited from solutions of its thiosalts in an impure condition, the deposit being too heavy; these measurements had to be carried out in an atmosphere of hydrogen, otherwise atmospheric oxygen oxidised the solution to some extent, and part of the current was used up in the reduction of these oxidation products. The experiments also show that an Sb anode goes into solution giving trivalent ions, and it is the trivalent ions which are deposited at the kathode. T. S. P.

1266. *Determination of Anions in the Electrolytic Way.* **J. H. Hildebrand.** (Amer. Chem. Soc., Journ. 29. pp. 447–455, April, 1907. Contribution from the John Harrison Lab. of Chemistry.)—By the use of an anode of heavily silvered Pt and a mercury kathode the author has succeeded in estimating each of the anions Cl, Br, I, CO_3, CNS, $Fe(CN)_6$, and PO_4, and the kathion Na at one and the same time. The best results were obtained with the following apparatus: The anode consisted of two circular discs of Pt-gauze 5 cm. diam. and having 80 meshes per sq. cm. They were mounted 5 mm. apart on a stout platinum wire 1 mm. diam. and 10 cm. long, which passed through the centres of the discs and perpendicular to them. The electrolytic cell used was a divided one, the amalgam being formed in one compartment and decomposed in another. The outer cell consisted of a crystallising dish of 11 cm. diam., and the inner cell was a beaker with the bottom cut off and 6 cm. in diam., and supported on a large Y of thin glass rod on the bottom of the dish. Enough mercury was poured in to seal off the two compartments, and then the solution to be electrolysed was put into the inner compartment, while in the outer were placed distilled water and a few c.cm. of a saturated solution of common salt, in order to give a conducting solution. Kathodic connection was made with the mercury by means of a coil of nickel wire. On electrolysis the anion combined with the silver, giving an adherent deposit of the silver salt, which could be washed, dried, and weighed, and the sodium formed caustic soda in the kathodic compartment. After the electrolysis was complete the entire contents of the cell were poured into a beaker, the cell rinsed, and the alkali titrated. The best results were obtained with a rotating anode, since with stationary anode the deposit was not always adherent. Rotating the anode also had the advantage that the amalgam was completely decomposed in the outer compartment; the end of the electrolysis was indicated by the current falling to 0·01 amp. or less, since nothing but pure water remained in the anodic compartment. The speed of the anode was about 300 r.p.m. In each case the weight of sodium salt taken was such that the weight of Na was 0·02 to 0·04 gm. The voltage required varied from 3 to 5 and the current from 0·5 to 0·01 amp., the time being from 30 to 120 min.; the time factor is to receive further attention. The method was found to be unsuitable for such salts as the arsenate and oxalate of sodium and potassium chromate. It is noteworthy that carbonates give quantitative results. The author points out that mixtures of salts, *e.g.*, of NaCl, NaBr, and NaI, can be readily estimated by weighing beforehand, titrating the alkali, and weighing the halogen. T. S. P.

1267. ***Rôle of Caro's Acid in the Electrolytic Formation of Persulphuric Acid and its Salts.*** **E. Müller** and **H. Schellhaas.** (Zeitschr. Elektrochem. 13. pp. 257–280, May 31, 1907. From the Laborat. f. Elektrochem. u. techn. Chemie d. Kgl. techn. Hochschule, Stuttgart.)—The first part of this paper gives an account of experiments on the electrolysis of sulphuric acid under different conditions of concentration, temperature, &c. The current yield was determined by measurement from time to time of the oxygen liberated at the anode; the persulphuric acid ($H_2S_2O_8$) and Caro's acid (H_2SO_5) were measured volumetrically. H_2O_2 was never formed in more than traces; in most cases it was absent. The best yields are obtained with acid of sp. gr. 1·39, low temperatures giving an increased yield. The current yield first rises to a maximum and then falls; decrease in yield and increase in the concentration of Caro's acid are corresponding factors. The concentration of the persulphuric acid formed generally increases at the beginning of the electrolysis, and becomes constant after some time. According to the authors persulphuric acid is primarily formed at the anode, and then decomposes according to the equation $H_2S_2O_8 + H_2O = H_2SO_4 + H_2SO_5$, the velocity depending on the concentration of the persulphuric acid. The Caro's acid is then destroyed at the anode, oxygen being evolved according to the equation $H_2SO_5 + 2OH' + 2F = H_2SO_4 - O_2 + H_2O$. The formation of persulphuric acid depends on the potential at the anode, and measurements of this potential show that it first rises and then remains constant, corresponding to the alterations in the concentration of the persulphuric acid. A continued rise in potential (and corresponding increase in the concentration of the persulphuric acid) is prevented by the formation of Caro's acid, which acts as a depolariser. The addition of hydrofluoric acid does not destroy the Caro's acid, but it increases the anode potential, and hence there is an increase in the current yield. The addition of substances such as SO_2, H_2S and HCl also increases the yield, since they reduce the Caro's acid as it is formed, and at the same time there is a rise in the anode potential; this rise is not primarily due to the addition of these substances, but to the diminution in the concentration of the depolariser, Caro's acid. Further experiments with solutions containing equivalent concentrations of SO_4-ions and of different kathions (NH_4, Na, K, Al and Mg) also gave the result that the higher the anode potential the greater the yield. Wherein lay the specific influence of the kathions could not be ascertained. The above results were applied to the electrolytic preparation of the persulphates of sodium and ammonium; the preparation of these substances is successful, because their great solubility is very much diminished in concentrated solutions of sodium or ammonium sulphate which are strongly acid with sulphuric acid. The remainder of the paper is occupied by a theoretical discussion based on the oxidation potentials of Caro's acid and persulphuric acid; the theory lacks experimental proof, however, since these potentials have not so far been measured. [See also Abstracts Nos. 3338 (1904) and 284 (1906).] T. S. P.

REFERENCES.

1268. *Microchemical Detection of Sulphur, Selenium, and Tellurium in Copper.* **F. W. Hinrichsen** and **O. Bauer**. (Metallurgie, 4. pp. 315–317, May 22, 1907.) —The authors offer chemical explanations of the origin of the characteristic colours obtained as mentioned in Abstract No. 617 (1906), for which the original paper should be consulted. In the case of Te, the addition of alcohol and cadmium acetate is not necessary. F. R.

1269. *Preparation of Pure Neodymium Oxide and Two New Methods of Separating Rare Earths.* **O. Holmberg.** (Zeitschr. Anorg. Chem. 53. 1. pp. 83–134, March 12, 1907. Universitätslaborat., Upsala, Jan., 1907.)—A study of the fractional crystallisation of the salts which the rare earths form with organic acids; the salts of *m*-nitrobenzene sulphonic acid proved to be especially suitable for fractionation. D. H. J.

1270. *Optical Properties of Tetramethylammonium Platinocyanide.* **J. Milbauer.** (Zeitschr. Anorg. Chem. 53. 1. pp. 135–136, March 12, 1907. Chem. Laborat. der k.k. böhm. techn. Hochschule, Prag.)—This is a colourless crystalline platinocyanide, and is of special interest as not exhibiting dichroism or triboluminescence [compare Abstract No. 93 (1906)]. D. H. J.

1271. *Conductivities of certain Fused Salts and Methods of determining them.* **R. Lorenz** and **H. T. Kalmus.** (Zeitschr. Phys. Chem. 59. pp. 17–30, April 23, 1907. Laborat. f. physikal. Chem. und Elektrochem. d. eidg. Polytechnikums, Zürich, 1905–1906.)—The authors give the results of measurements of the conductivities of fused potassium nitrate, sodium nitrate, potassium dichromate, lead chloride, and lead bromide at various temperatures, the mean errors being in all cases less than 0·38 per cent. The methods of measurement are described. T. H. P.

1272. *Conditions under which the Law of Dulong and Petit applies.* **A. Wigand.** (Phys. Zeitschr. 8. pp. 344–346, May 15, 1907. Physikal. Inst., Marburg, April 3, 1907.)—A discussion on the subject in which it is put forward that the exceptions to the law of Dulong and Petit can be brought into line by stating that for every element there is a certain range of temperature within which the law applies approximately. L. H. W.

1273. *Solubility of Electrolytes.* **J. J. van Laar.** (Zeitschr. Phys. Chem. 59. pp. 212–217, April 30, 1907.)—A theoretical paper in which the constants which determine solubility are worked out from Walden's data. T. M. L.

1274. *Equilibrium between Ammonia and Hydrogen Sulphide.* **J. P. Magnusson.** (Journ. Phys. Chem. 11. pp. 21–46, Jan., 1907.)—A reinvestigation of the subject shows that the phenomena are in accord with the mass-action law; apparent discrepancies are explained by the adsorption of ammonia by solid ammonium hydrosulphide. Incidentally a description of an efficient electric thermostat is given by the author; rise of temperature produces interruption of a mercury contact in the electric circuit. D. H. J.

1275. *Suspensions in Dilute Alkaline Solutions.* **W. R. Whitney** and **A. Straw.** (Amer. Chem. Soc., Journ. 29. pp. 325–329, March, 1907.)—The authors describe some experiments which they have not been able to complete. It has been found that a trace of alkali increases the stability of colloids (as had been observed by Bredig) and also of suspensions. They have not been able to find the explanation of the effect, but suggest that it is due to an alteration in surface tension of the water. A. F.